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ANATOMICAL FACTORS IN OCCUPATIONAL TRAUMA.

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PHYSICAL EDUCATIONALISTS have realized for some time that the maximum degree of efficiency of any movement can be obtained only by the proper coordination of all the muscles acting upon all the joints concerned in the movement. Similarly coaches and physical trainers have come to appreciate that what they call "good style" is in reality a maximum muscular efficiency allied to a maximum economy of effort (Perrott, 1959), and the comment "How easily he does it!" is possibly the highest praise that can be bestowed upon the expert performer. Again, the relationship of posture and muscle tonus to the coordination of group movements of muscles has been a factor which influences the minds of the trained physical educationalist in the practice of his profession. Until these factors were recognized and then applied, physical education remained in its infancy, and "physical training" in schools was to be compared with a man trying to drive a car with the brake on.

With the vast strides that physical education has made in the last decade, largely owing to the application of the knowledge of mechanical anatomy, it seems deplorable that this same application has not yet found its way into the prophylaxis of the large variety of occupational trauma that occurs in industrial workers. Not that factory surgeons and occupational health departments are unmindful of the need of a careful analysis of limb movements in the diagnosis of strains and frictional injury; but it is rather a failure to appreciate what is actually normally taking place in articular and periarticular tissues as a particular joint moves within its extreme limits. Furthermore, the useless expenditure of effort in, for example, lifting heavy weights, pushing movements or rapid digital manipulations has often resulted in joint, tendon and muscular injuries as well as in herniæ and fatigue fracture. The anatomical "know how" could have obviated the most minor trauma by (i) eradicating all unnecessary movements, (ii) enlisting the aid of gravity, (iii) the use of muscles as prime movers which are meant to be used as prime movers for any given movement, that is, correct usage of muscles according to their actions, (iv) the use of the most economical poise and the correct balance of the body, (v) the minimum employment of shearing strains and torsions upon joints.

It is no exaggeration to say that if each of these five principles was rigidly adhered to and supervised by an energetic medical officer or educationalist, the occupational trauma in our factories and workshops would be greatly diminished.

Unnecessary Movements.

Movement may be defined as an observable change of position. This change of position may concern the body as a whole — that is, propulsion resulting in locomotion — or it may occur around (*a*) an axis within the body (for example, flexion or extension of a joint), or (*b*) a point of contact outside the body — for example walking or pirouetting on the toes.

All movement requires some sort of force to produce it, and whenever muscle produces movement, it performs work which in turn produces fatigue. It follows from this that even a minute additional excursion of a joint in any direction will produce cumulative fatigue if

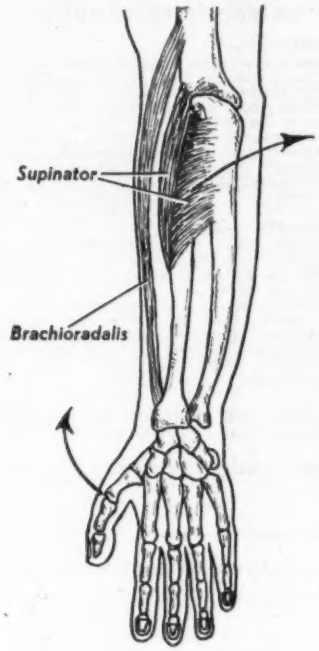

FIGURE I.
Laterally rotating action of the supinator upon the radius.

performed several thousand times; and if that excursion is in an anti-gravity direction, the fatigue produced and intramuscular katabolites accumulated will be even greater.

CASE I.—Women aged between 18 and 35 years assembling electric motors were required to thread a series of fine wires through small loops. In order to carry this out, they lifted the coil weighing about 10 lb. and rotated it through nearly 180° by supinating their forearms. Some 90 such coils were thus dealt with by each woman in the course of a three to three and a half-hour shift without break. However, a few of the women were noticed to "roll" the coils over without lifting them in order to catch the wire thread on the reverse side, both hands being used equally in this rolling movement. The repeated supination with a weight of 10 lb. had produced a strain upon the superior radio-ulnar pivot joint, with or without a supinator lesion, which resulted in pain and disability akin to "tennis elbow". (Figure I, from Perrott, 1959.)

It can be seen how the brachio-radialis muscle, which might have assisted the supinator in the final stages of supination (from the mid-prone position), was additionally employed in flexing the elbow joint in the lifting action. Supination is a strong movement, but when it is employed in conjunction with flexion of the elbow joint, much of its power is lost, since (*a*) brachio-radialis and (*b*) biceps brachii dissipate their power in attempting to perform both movements simultaneously.

Enlisting the Aid of Gravity.

It will readily be appreciated that any limb muscle is acting against gravity from a position of rest and "all our lives we fight the indomitable force of gravity"; but the so-called "anti-gravity muscles" are those which are primarily concerned with maintaining the erect posture, and with moving the limbs from the anatomical position. This position is one of standing erect with the feet together, the arms supinated by the side and the head held erect facing anteriorly. To illustrate the action of gravity, the abducted arm is brought down to the side of the body almost entirely by gravity, and yet the movement can be controlled by the eccentric work done

FIGURE II.

by the deltoid and supraspinatus in allowing the arm to fall slowly to the side.

In a similar way, the sacro-spinalis group carry out their controlling function by lengthening their fibres in forward flexion of the trunk, and in each case considerable muscle fatigue is observed if the movements are prolonged. Nevertheless, it is obvious that if the movements are performed against gravity (in the opposite direction), the onset of fatigue will be much earlier and the strain upon hard and soft tissues much more severe. The simple example of pulling on a hanging rope around an overhead pulley is all too frequently carried out only by arm and shoulder muscles, when the weight of the body alone would achieve the downward pull, the hand grip acting as an attachment. Gravity does the job for us. Any heavyweight who has taken part in a tug-o'-war knows the value of "lying back" at an angle of less than 45° with the ground so that his body weight is added to the power of his pull. Again, gravity is our friend, not our foe.

While these examples may be self-evident when large muscles and total limb or body weights are concerned, the influence of gravity upon the tendons of the wrist and digits is not so apparent.

CASE II.—An unmarried woman, aged 22 years, was employed as a paster of cigarette cartons in a firm of

cigarette manufacturers. She pasted down the flaps at both ends of a carton containing 25 packets of cigarettes, and dealt with approximately 2000 cartons in the course of a three-and-a-half-hour shift. The method adopted was as follows: After application of the adhesive solution to the vertical cartons, a downward pressure of the thumbs and digits (flexion) ensured the sealing of one end (Figure II). The carton was then rotated around its transverse axis without any lifting (Figure III). The other end was similarly pasted and compressed. The cartons were then packed into a box placed on the floor by a separate packer.

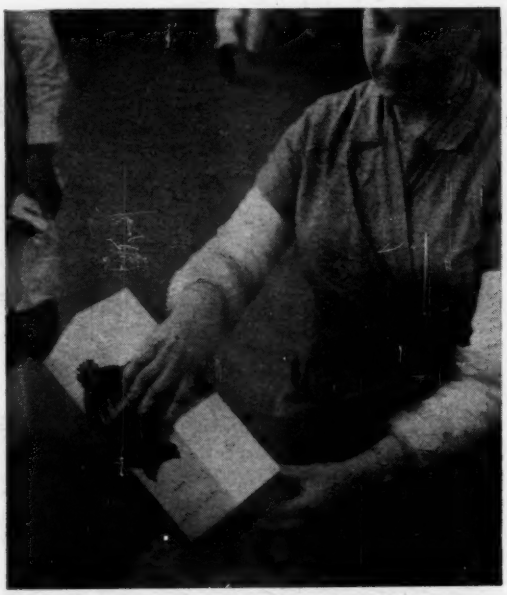

FIGURE III.

CASE III.—A married woman, aged 37 years, was employed as a paster of cigarette cartons in the same firm of manufacturers as the subject in Case II. The method of pasting which she adopted was as follows: Each carton was laid horizontally upon another, and one of the ends was pasted and then compressed by an adduction and extension of both thumbs (Figure IV). The carton was then turned round by raising it in cantilever rotation to the vertical position (Figure V) when it rested upon its sealed end. The upper end was then sealed by compressing the flaps with adduction and extension movements of the thumbs horizontally. As the cartons at the bottom of the pile were reached (Figure VI), the vertical adduction and extension of the thumbs also compelled considerable dorsiflexion of the wrist against gravity.

Comment

In each of these two cases, the paster seals some 2000 cartons in the course of three and a half hours. However, it should be noted that in Case III, Figures IV and VI show the additional work involved in the thumb movements against gravity, while Figure VI indicates the additional strain placed upon the extensors and long abductor of the thumbs by the associated dorsiflexion of the wrist joint. In addition to this unnecessary expenditure of effort, this paster subjects herself to the effort of raising the carton in cantilever fashion by pronating both forearms with fingers flexed (Figure V). As each of the cartons weighs 1·75 lb. she will lift 3500 lb. or just over 1·5 tons in the course of three and a half hours. The other paster (Case II) does not impose this work upon herself, but her output is the same. Some of this strain might have been obviated if the paster in Case III had used the subjacent carton to act as a fulcrum upon which the carton above could be swung into the vertical position, but this was not the case. The carton weighing 1·75 lb was lifted from its nearest end by the weaker pronators (pronators being weaker than supinators). The whole movement was then impeded by the flexion of wrist and fingers of the right hand, and the extension of the wrist and flexion of the fingers of the left (Figure V).

In Case II the paster not only enlists the aid of gravity in rotating the carton around its transverse

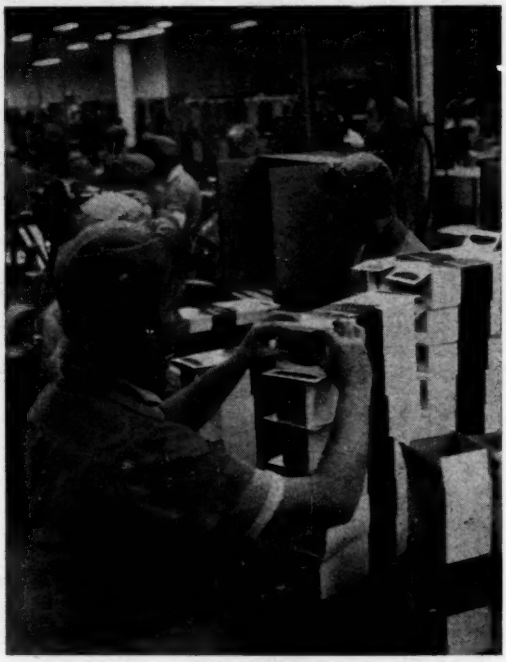

FIGURE IV.

axis, but also employs the stronger supinators when she has to work against gravity (Figure III). Furthermore, she employs the momentum of the carton obtained by gravity to raise the unsealed end uppermost.

It is not surprising to find that a number of the women employing the method used in Case III suffered from teno-synovitis. Some of these lesions were severe.

Correct Usage of Muscles According to their Actions.

In order that a movement within a joint or series of joints may be carried out smoothly, with the maximum efficiency and the minimum expenditure of effort, there must be controlled and coordinated team-work amongst the muscles concerned. It does not matter whether these movements are simple or complex, the muscles must be so used that they cooperate with each other in obtaining the ultimate excursion of the joint. This cooperation of flexors, extensors, adductors, abductors and rotators is known as group action and is concerned in every movement of limb, trunk and head which we are capable of carrying out. It follows that only certain muscles are directly responsible for effecting a given movement (prime movers) — for example, the gastrocnemius is directly responsible for flexing the ankle joint. However, there are other muscles which assist these prime movers; these are as follows: (*a*) Synergists prevent hindering movements taking place at the same time, and therefore prevent wastage of power of the prime movers. For example, the supraspinatus holds the head of the humerus into the glenoid cavity while the deltoid

is acting as the prime mover in abducting the shoulder joint. (*b*) Fixationists help to keep the origin of a prime mover static so that the latter muscle can exert its force more powerfully upon its area of insertion. For example, the hamstrings act as extensors of the trunk via the pelvis when the knee is extended by the quadriceps, the fixationists. (*c*) Antagonists control the action of the prime movers by relaxing — that is, "paying out" as the

FIGURE V.

prime movers are contracting. This is especially the case of antigravity antagonists such as the deltoid. Generally speaking, antagonists have the opposite action to that of the prime movers, and yet they assist the action of the latter by their relaxing control. If this was not so, every movement would become a snap action like a pocket knife springing back into its guard.

Any series of movements which are carried out without the cooperation of synergists, fixationists and antagonists acting as a team, of which the prime mover is the captain, will be carried out with an unnecessary expenditure of effort and an earlier onset of fatigue. The three commonest examples in which this occurs in industrial manual workers are as follows: (i) work carried out with the hands at or above the level of the face; (ii) work carried out with the hands below the level of the knees; (iii) work carried out with an inadequate space requirement.

CASE IV.—A married man, aged about 40 years, was employed as a fitter in a paper mill. Part of his work entailed turning a metal wheel 2 ft. in diameter placed some 7 ft. above the level of the ground upon which he was standing. His own height was 5 ft. 11 in., and he was therefore forced to raise his arms up to 1 ft. above his head. On the assumption that the average upper limb reach of a man is 33 in., this motion involved an almost fully extended elbow at some stage of his work (Figure VII). The wheel is used to open and close a steam valve, which had become tightened owing to chemical reaction and pressure changes.

Here we have an example of a powerful adductor of the right shoulder joint, the pectoralis major, being forced to work as an antigravity muscle at the same time as performing its action as a prime mover. Simultaneously the right biceps and brachialis acting against gravity (the right arm being raised) have also to act as a supinator of the forearm and a flexor of the elbow joint respectively, as the wheel rotates clockwise.

In the case of the left arm and the wheel rotating clockwise, there is the work done by the anterior fibres

FIGURE VI.

of the deltoid and part of the pectoralis major, also performed against gravity so far as the shoulder joint is concerned. Scapular rotators and fixationists will have additional work to perform, and since the glenoid cavity is facing upwards, rhomboids are stretched and additional work is placed upon the serratus anterior in keeping the scapula close to the chest wall while rotating its inferior angle laterally (see Figure VIII).

Comment

This is certainly an extreme example of wastage of muscle power. If this operation of rotating the heavy wheel from this position was performed for long periods without rest, there is no doubt that a muscular or ligamentous breakdown would occur, no matter how strong the man was, or well trained he might be to carry out this type of work.

Hunsicker (1955) showed that strength which can be exerted varies with the angle of flexion of the elbow as well as with the degree of elevation of the arm. In each position of the upper part of the arm (Figure IX), movements were made in (*a*) an upward and (*b*) a downward direction, during which the angle of the upper part of the arm varied from 180° (horizontal) to 60° (30° backwards from the vertical). The strength of each subject was automatically recorded and measured in pounds weight lifted or pulled down. The results were indicated on the dial of a strong spring balance.

TABLE I.

Angle of Arm	Up		Down	
	Left	Right	Left	Right
180°	41	43	35	41
150°	52	56	41	47
120°	54	60	51	58
90°	52	56	49	53
60°	44	49	46	51

These figures show that the maximum strength can be exerted when the arm is almost by the side of the body — that is, at an angle of 120°; but in each case the subject was sitting bolt upright with his feet on the ground.

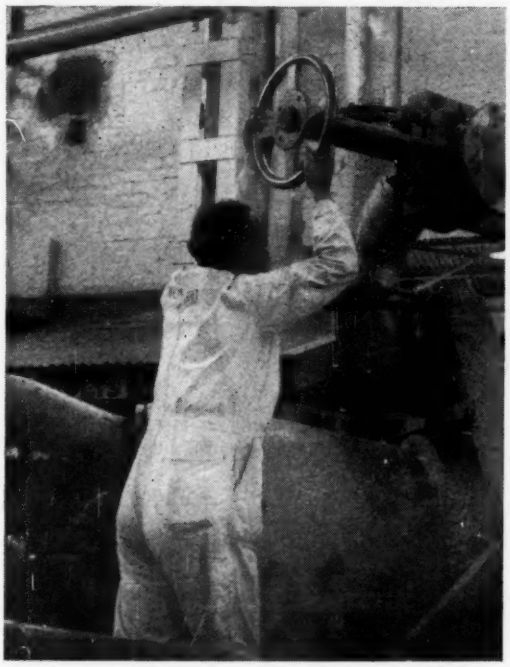

FIGURE VII.

A momentary consideration will reaveal the anatomical reasons for such an optimum poise:

1. The line of gravity of the body passing just anterior to the vertebral bodies is not altered as it is in the photograph (Figure VII) with the man leaning forwards.

2. Muscles of the shoulder and upper limb girdle are no longer acting against gravity, and the upper arm muscles can use the humerus to act as a lever acting upon a second lever (radius and ulna). The angle between these levers can be adjusted at the elbow joint. Anyone who has used an angled crow-bar knows the mechanical advantage of such a tool.

3. Internal or external rotation of the shoulder joint can occur to a small extent without jeopardizing the lifting or pulling power of the arm. Hence the rotation of the wheel in Figure VII would be facilitated.

With these factors in mind, it becomes apparent that the remedy of these mechanical disadvantages will involve the raising of the man's body to such a level that the optimum poise outlined above will be adopted. This will entail the erection of a level platform or rostrum, mounted upon which will be a fixed stool of such height that the arms of the operator are operating between the angles of 120° and 90° (see Figure IX and Table I). Indeed, it does not matter how infrequently this wheel has to be turned, the strain will always be the same upon the muscles of the upper limb girdle and the back, although the more frequently this "unanatomical" work, as exemplified in Figure VI, has to be performed, the more rapidly will the results be cumulative.

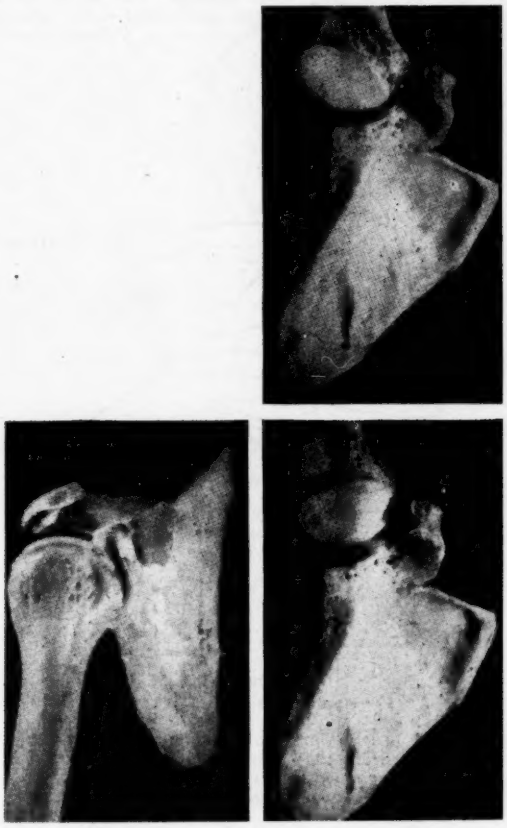

FIGURE VIII.

A, anterior aspect of shoulder joint with arm by side; B, lateral rotation of scapula in elevation of arm.

Economical Poise and Correct Balance.

While the previous case was an excellent example of a most uneconomical poise, there are many other instances in which either serious or temporary damage is done to soft tissues in carrying out strenuous labour in domestic or industrial work. It is not only in lifting of heavy and cumbersome objects that these injuries occur, but strains are also found to arise from pushing and pulling actions — actions which of themselves do not appear to involve great exertion for the average man; yet if the doctor inquires carefully into the position of the body (poise) with particular reference to the position of the feet at the time of the exertion, he will frequently perceive that the whole equilibrium of the body has been upset to such a degree that one joint or several weaker joints have been overloaded with the force necessary to carry out the work. The greater strength of the lower limbs and the use of momentum in movement have been forgotten. Other mechanical items which are neglected are (*a*) positions of the feet, so that the line of gravity always passes through the anterior part of the ankle joint (*b*) a straight or

extended back, (*c*) arms held close to the body (Figure IX), (*d*) full use of weight of the body, (*e*) firm grip.

Poise and balance of the body are really complementary to each other, for a good poise may be said to be obtained when the body is in such a balance that every physical activity can be carried out with the maximum degree of efficiency and the minimum expenditure of effort (Perrott, 1959). Nevertheless, posture and poise must not be confused with habitus. The latter is the build or physical type of the individual — for example, short and squat or long and wiry — and although habitus

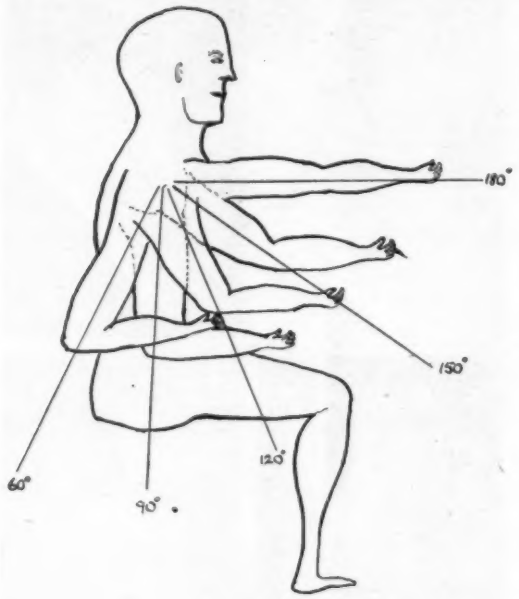

FIGURE IX.
Maximum strength, 120°.

often has a bearing on the poise of the individual, the reverse is never the case. Habitus is a racial or hereditary characteristic; poise is acquired, but may be secondary to habitus. Balance is dependent upon the line of gravity. This line (Figure X) passes vertically downwards from just in front of the vertebral column, through the hip joint and the anterior part of the knee and ankle.

The line in Figure X shows the position of a coronal plane (the plane of balance) dividing the body into unequal anterior and posterior portions, of which the anterior is the larger. It follows that the extensors of the back will have to be stronger than the muscles of the abdominal wall, and the extensors of the knee joint stronger than the flexors if the body is to remain upright. (This fact is demonstrable in strychnine poisoning with the spasmodic contractions producing opisthotonus.)

The practical application of these factors is exemplified in the correct method of lifting heavy weights from the floor. The body must be used as a counter-balance to the lifted weight. Hence, if the trunk is bent too far forwards or the knees are not flexed sufficiently, it is apparent that the sacrospinalis complex is being used as a cantilever, and is at once placed at a mechanical disadvantage; for not only are the back muscles acting in a line at right angles to the pull of the weight, but they are also placed in front of the line of gravity of the body (Figure XI).

This is often a direct cause of intervertebral sacro-iliac and sacro-spinalis injuries, and could be obviated to a large extent by adopting a more economical poise, in which the line of gravity of the body lies in front of the main body weight. This balance would then enlist the aid of the body weight in lifting the load, for the line of gravity lies on the opposite side of the pivot (the feet) to that on which the load is situated. Such a situation can be obtained by flexing the knees to just beyond a right angle with the long axis of the vertebral column tilted forwards by 20° (Figure XII).

Instead of working against gravity, the sacro-spinalis and its synergists act as a complex brace to the vertebral column, and attached to this brace are the trapezius, rhomboids, levator scapulæ and latissimus dorsi, all of

FIGURE X.
The line of gravity (lateral aspect).

which contribute to the musculature of the upper limb girdle. This can now act as an articulated crossbar from which the upper limbs are suspended. Moreover, the whole mechanism is reinforced by the strong lower limb and gluteal muscles, so that the weight-lifting action is primarily carried out by the strong extensors of knees and hips producing an upward thrust from the initial flexion of the knee joints. It has been shown experimentally that a difference of nearly 300 lb. can be lifted by these methods.

Lifting is by no means the only severe exertion in which the working man may injure himself by placing his body at a mechanical disadvantage. Figures XIII and XIV show the energy which is wasted by a muscular man in pushing a heavy object.

In both these cases a man weighing 16·5 stone is attempting to push of vehicle weighing 27 cwt. In each case the weight of the man's body is of little assistance to him. In Figure XIII his hands are turned inwards and the flexors of the wrist joint are acting around the extended wrist thus weakening their action. The elbows are flexed and therefore the extensors, which will be

the prime movers, are weakened around the bend of the elbow. If they were used as rigid extended levers, the position would be more favourable, provided that the angle of the body with the ground was diminished so that body weight could be used to better advantage.

Figure XIV shows a more advantageous position, since lower limb muscles are playing a more active part in the push; and yet here again the full body weight is not employed, and the man is apt to be unbalanced as the car moves forward. The vertebral column is flexed to counterbalance the poor equilibrium,

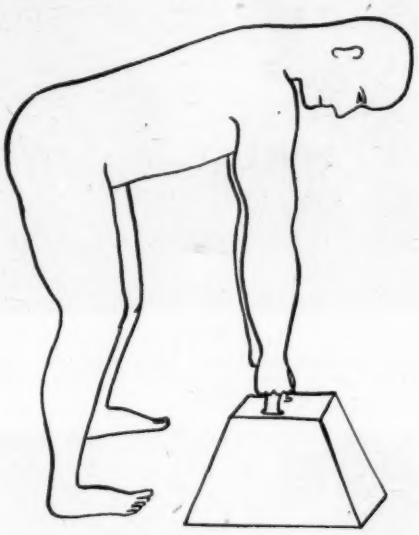

FIGURE XI.
An uneconomical method of lifting a heavy weight from the floor.

with the result that the shoulders play little or no part in a combined thrust; the buttocks act as a buffer. Injury may follow if his foot slips or the car moves forward suddenly.

Figure XV indicates the most economical poise and balance for this type of work. The movement is started by the straightening of the right (rear) knee, and the force is transmitted almost directly through the line of gravity of the body as far as the left side of the upper limb girdle. The stronger extensors of the knee, hip and back are all working as a team, and the push is supplemented by the upper limbs, the right arm maintaining the equilibrium. Momentum will be maintained and gained by the extending thrust of the left (front) knee followed by the right knee alternating as forward propulsion is maintained.

The success of the whole combined action has depended upon (*a*) the correct positioning of the feet to achieve a balanced thrust, (*b*) the straightening of the back to transmit the force directly, (*c*) the application of the upper limb girdle to the weight propelled forwards and (*d*) the correct positioning of the hands, in this case to assist equilibrium and to supplement the applied force.

Minimization of Shearing and Torsion Strains Upon Joints.

It is well recognized that each joint in the human body has certain specific movements which it is capable of carrying out; it is equally apparent that there is a certain limitation of these movements, in which the excursion is limited by bony apposition, by cutaneous apposition or by ligamentous tension. For example, dorsiflexion (extension) of the wrist is limited by the anterior radio-carpal ligament, while ulnar deviation (adduction) is much greater than radial deviation (abduction) owing to the early contact of the large radial styloid process with the trapezium and, in fact, radial deviation is largely a mid-carpal movement.

In the important forearm movements of pronation and supination, we have a rotation of the radius around an axis which is represented by a line drawn from the centre of the head of the radius to the ulnar styloid

FIGURE XII.
Muscles and back, shoulder girdle and lower extremities are acting as an anti-gravity team against a heavy weight.

process. The result is that the radius comes to lie across the ulna in pronation, whereas in supination the bones lie side by side. In order to perform this rotatory movement, the radius is tethered to the ulna superiorly by the annular ligament and inferiorly by the articular disc of the inferior radio-ulnar joint. The hand is carried round with the radius, and thus no rotation can occur around a logitudinal axis passing through the wrist joint. The range of pronation and supination shows great variation in different individuals, but ordinarily this range lies between 135° and 180° and is limited inferiorly by the bony apposition of the lower end of the radius against either side of the ulnar styloid process. The capsules of the wrist and elbow joint also play a part in this limitation.

Emphasis has been laid upon the wrist and radio-ulnar joints, because these belong to the small non-weight-bearing synovial joints which are so often abused in spite of their generous mobility. Stability of joints is mainly dependent upon their neighbouring muscles, although bony configuration and ligamentous strength are contributing factors. This stability is of paramount value in the case of lower-limb weight-bearing joints;

but in the case of the smaller upper-limb articulations, mobility has taken the place of stability, and it is not surprising that it is in these smaller and weaker joints

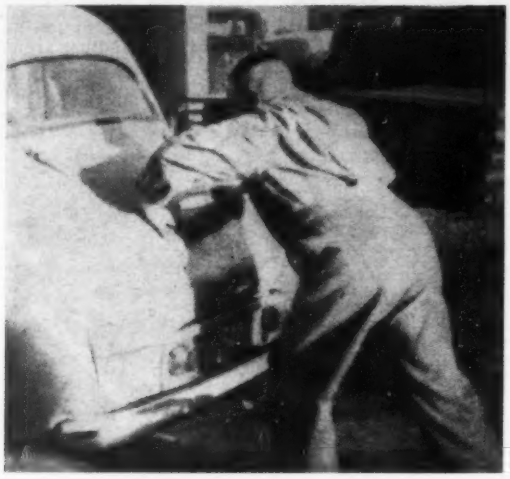

FIGURE XIII.

Incorrect. Note that the hands are turned inwards; also that elbow and wrist joints are not in a rigid locked position.

that we find the majority of torsion and shearing strains occurring in industry. These strains occur as a result of (*a*) imposing a great or prolonged load of

FIGURE XIV.

Better than Figure XIII, but the man is in unstable equilibrium; if the car moves suddenly forward or his foot slips, injury can follow.

work, (*b*) repeated attempts to increase the range of movement, (*c*) poor muscle tonus and (*d*) lack of coordination of group movements of muscles (see section on correct usage of muscles).

Ligaments which limit movements are generally the first to suffer, and these ligaments also include the capsules of joints in which minor tears commonly occur. Muscles are far less commonly damaged than is generally supposed for they are expansile and can be made to stretch far beyond their normal limits; indeed, diagnoses of "torn muscles" or "muscular strain" are all too frequently made as a result of tenderness on pressure over a muscle, when the true lesion lies within an underlying ligament, bursa or even bone.

FIGURE XV.

Correct. Note shoulder and hand positions. Body weight is used fully, but position of feet ensures stability.

FIGURE XVI.

Handling an assembled motor weighing 15 lb. 6 oz. The operator has just picked it up from a conveyor belt 18 in. away, and is turning it up through 90°. Twenty-five motors per hour; abduction of wrist against gravity.

Where many tendons cross a joint or series of joints, as they do in the case of the wrist, intercarpal and digital joints, then the synovial sheaths and their contained lubricant are candidates for injury as a result of torsion and extreme excursion of those joints. Teno-

synovitis may, of course, occur as a result of excessive use of the tendons without any torsion, but when the latter is added to normal excursions of the tendon within its sheath, then teno-synovitis is a common result.

CASE V.—A married woman, aged 37 years, was employed by a firm manufacturing electric motors and other electric equipment. Her duty for the past two and a half years had been to assemble fractional horse-power electric motors. This involved picking up the metal casing of the motor weighing 15 lb. from a roller conveyor about 18 in. in front of the bench at which she stood (Figure XVI).

In the course of the assembling process, each motor had to be lifted off the bench twice and each time rotated through 90°. Some 25 such motors were thus dealt with in the course of an hour, requiring a lift of 15 lb. with both hands in the mid-prone position accompanied by abduction of the hand and an associated pronation of the forearm about 50 times during the hour. The average shift was of two and a half to three hours' duration, so that this combined "un-anatomical" movement was carried out about 125 or 150 times.

This woman complained of pain on the backs of both wrists and "stiffness" of the right thumb; a diagnosis of teno-synovitis of the right extensor pollicis longus and extensores carpi radialis longus and brevis had been made.

Comment.

Abduction (radial deviation) of the hand takes place mainly at the mid-carpal joints, owing to the early apposition of the large radial styloid process against the scaphoid, which maintains its position relative to the radius, performing a gliding movement only. However, ulnar deviation (adduction) of the hand occurs mainly at the wrist (radio-carpal) joint, with the proximal row of the carpus moving so that the triquetrum approaches the ulna, and the lunate and scaphoid undergo a rotation upon the lower end of the radius. The range permitted by ulnar deviation is more than twice that of radial deviation, although there are individual variations (Figure XVII).

Supination is a far stronger movement than is pronation, since the powerful biceps brachii and the brachio-radialis (supinator longus) assist the supinator against the smaller, shorter and weaker pronator teres and quadratus.

It would therefore appear that if the worker had employed an ulnar deviation of the wrist joint combined with a supination of the forearm to perform these 50 rotatory movements per hour, she would have obviated a considerable degree of torsion of soft tissue around these joints. This would have involved rotating the 15 lb. motor away from her instead of towards her, and this action of itself would have resulted in working with gravity (in adduction of the wrist the hands would descend with the weight) instead of against it.

Lest it should be argued that speed of manipulation would be lost by the learning of a new method, it must be observed that habit formation appears easy, but habit breaking is difficult only in the non-cooperative. If the initial learning is easier than relearning of another method, then persuasion, demonstration and perhaps reasoning on the part of the instructor must be a dominant feature in the prevention of all these industrial injuries.

CASE VI.—An unmarried woman, aged 29 years, was employed as fabric checker in a firm manufacturing woollen fabric. She had been employed for 13 years picking out faulty threads which contained minute knots or "slubs". A large sheet of woollen terylene was placed on a table before her, and she sat at an appropriate height under a good light palpating the faults and then withdrawing the offending threads with a pair of small tweezers (Figure XVIII). This work was carried out by holding the tweezers tightly between the index finger and thumb of the right hand, and when she had found the thread, a sharp dorsiflexion (extension) of the wrist resulted in the extraction of the thread. This thread was replaced by another without a fault.

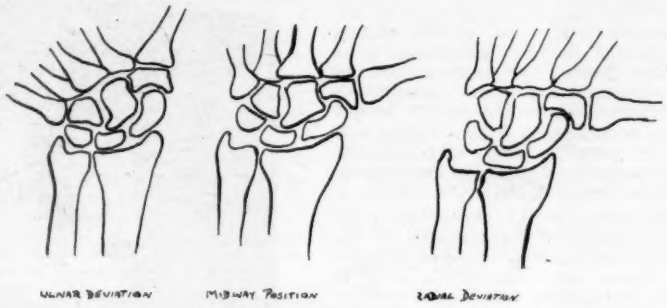

FIGURE XVII.

The number of times that this movement was carried out varied enormously with the number of faults detected; but if an average of one faulty thread per minute was detected, in a day's work of eight hours some 480 sharp extensions of the wrist would be performed provided the thread was removed at the first effort.

For the past year this woman had complained of an intermittent tingling sensation in the right thumb, and the right index and middle fingers, which was worse at night. In the past three or four months this sensation had become more severe, and was now bad enough to keep her awake at night. Sometimes at work it "came on like an electric shock", and her fingers on the right hand felt numb and weak. Occasionally at home after work she had difficulty in holding small objects such as a teacup or a table knife. On being questioned more closely as to the distribution of the sensations, she indicated that only the thumb and index and middle fingers were involved, but the little finger and palm were free from trouble, while she was "not sure" about the ring finger. There was no coldness, discoloration or sweating of the digits involved, and no apparent wasting of the thenar or interosseous muscles. A diagnosis of carpal tunnel syndrome was made.

Comment.

As the median nerve approaches the wrist, it escapes from between the deep and superficial flexors of the fingers. Passing deep to the flexor retinaculum, the nerve becomes flattened out into a pseudo-ganglion which lies superficial to the superficial tendons of the index and middle fingers. On its lateral aspect lie the flexor carpi radialis and, more deeply, the long flexor tendon of the thumb. Just distal to this pseudo-ganglion the nerve divides into lateral and medial divisions supplying the muscles of the thenar eminence and the skin of the palmar surface of the thumb, the index and middle fingers and the lateral half of the ring finger. In such an arrangement it is possible that the median nerve may be compressed by the neighbouring tendons as they

pass through the grossly congested tunnel formed by the flexor retinaculum bridging over the carpal concavity. When this compression occurs, it is known as the carpal tunnel syndrome, and it may arise either with or without a concomitant tenosynovitis or joint disorder.

The symptoms which typically follow such a compression are those of paræsthesia along the cutaneous distribution of the nerve, intermittent swelling of the digits and weakness of the thenar muscles. In certain cases there are vascular phenomena (blueness or ischæmia) in the digits, and wasting of the thenar muscles; these are generally associated with severe pains following the work involving repeated flexion and extension of the wrist and intercarpal joints.

While it would seem that extension of the carpus and wrist would induce the nerve compression to a greater degree than would flexion, this is by no means always the case. Compression of the nerve against the proximal border of the flexor retinaculum in full flexion of the wrist often occurs according to Brain, Wright and Wilkinson (1947), but the causative factor of this lesion is the repeated full excursion of the wrist and carpus in flexion, extension, adduction and abduction.

In this case the compression would almost certainly be accentuated by the contractions of the flexors of the index finger and thumb in holding the tweezers (Figure XVIII). Moreover, the sudden extension of the wrist is not facilitated by these antagonists having to act as prime movers. The remedy must lie in the relearning of a different type of movement in which the wrist and carpus have only minimal excursions. Such a movement for the withdrawal of the threads would entail an external (lateral) rotation of the shoulder joint associated with a supination of the forearm. This combination would not interfere with any digital manipulations or with the enforced flexion of digits or thumb in compressing the tweezers.

Conclusion.

It is quite remarkable that if the history of trauma acquired in industry is carefully investigated by assiduous interrogation, it is usually ascertained that the principal ætiological factor or factors are found in one or more of these anatomical misapplications. A careful analysis of the various types of movement which the patient has employed over a prolonged period in carrying out his duties reveals not only the site of the injury, but also the damaged tissue.

The patient's surprise that any injury could have been caused at all serves only to indicate that he was relying upon sheer muscular strength rather than upon the simple mechanical principles which diminish fatigue and wastage of effort, and at the same time enhance his efficiency.

Summary.

The correlation between muscular work and human efficiency is considered, and the prevention of injuries to articular and periarticular tissues is discussed in relationship to five principal factors.

1. Eradication of unnecessary movements and consequent dissipation of muscular power are advocated, as exemplified in the simple actions of rotation during the assembling of electric motors.

2. By allowing gravity to aid relatively light manipulations, the cumulative effects of fatigue are greatly reduced. Contrasting methods of cigarette packers are illustrated and discussed.

3. The action of prime movers, antagonists, synergists and fixationists is described, and the importance of muscular teamwork is discussed and illustrated by a case of gross wastage of muscle power in the upper limbs in rotating a wheel above the optimum level.

4. The value of poise and balance is stressed, and examples are provided in contrasting methods of lifting and pushing heavy objects.

5. Prolonged torsion and shearing strains upon joints and periarticular tissues are to be avoided if possible. Strain can be obviated to a large degree by working with gravity. A case is described of prolonged pronation and abduction of the wrist during rotation of a 15 lb. weight, which resulted in torsion sprains of both wrists and tenosynovitis. A case of carpal tunnel syndrome in a textile worker is also described.

FIGURE XVIII.

Acknowledgements.

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RESPIRATORY INSUFFICIENCY.[1]

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A Concept of Respiratory Insufficiency.

MOST of us are acquainted with various types of organ insufficiency or failure. For example, the presence of anginal pain, effort dyspnœa and systemic venous congestion leads one to think at once of cardiac insufficiency or failure. Similarly, an elevated blood urea level or proteinuria suggests renal insufficiency. The anæsthetist, in common with other clinicians, is disturbed when he finds any of these symptoms or signs, and takes appropriate steps to counter the dangers which they imply. It is disappointing, then, that most people do not have the same familiarity with the concept of respiratory insufficiency. A clear chest X-ray film and pink finger nails give no assurance that the respiratory mechanisms are adequate to withstand any anæsthetic, surgical or other noxious assault upon them.

If we are to define respiratory insufficiency, we must firstly define what we expect of normal respiration. The function of normal respiration is a simple one. It is to transfer oxygen from the atmosphere into the body and carbon dioxide from the body into the atmosphere, both of these functions being accomplished with the expenditure of minimal respiratory muscular effort.

A concept of respiratory insufficiency follows naturally from this: it is present when greater than normal effort by the respiratory muscles is necessary to keep the blood gases normal, or when the blood gases are no longer kept normal. This definition includes all grades from the compensated to the grossly decompensated, and serves as a good generic term. In its earliest form it presupposes merely the need for unduly increased respiratory work, when a load such as exercise is imposed on the person, though the blood gases will remain normal. At the other end of the scale, it is represented by the patient in whom compensation has failed completely, and who, despite increased efforts, has constant hypoxia and carbon dioxide retention at rest.

In this paper we shall refer to several aspects of respiratory insufficiency—first, some brief comments will be made on the concept of blood gases versus respiratory work, and secondly, something will be said about the underlying causes of respiratory insufficiency.

In order to determine whether respiratory insufficiency is present at the investigational level, it is necessary, in terms of our definition, to perform only two investigations: to determine the levels of oxygen and carbon dioxide in the arterial blood, and to determine the amount of respiratory work which is being done. Both of these investigations are more or less readily performed. If either finding is abnormal, then by our definition, respiratory insufficiency is present.

In practical terms, it is not usual to approach the problem in this way. The more usual approach is to suspect clinically that something is amiss within the respiratory apparatus, and then functionally to dissect respiration in order to find where the process has broken down. But even in suspecting that "something is wrong" with respiration, we are using the two bases referred to already: blood gases compared with respiratory work. We are impressed by cyanosis as a sign of low arterial oxygen saturation, by certain nervous and cardio-vascular signs of carbon dioxide retention, and by dyspnœa as a manifestation of increased respiratory work. These are very valid signs, provided it is remembered that they are fairly crude and therefore late ones—that they are more signs of advanced respiratory failure than of early respiratory insufficiency. Much earlier signs can be detected by more sensitive means if they are looked for, and this is one of the functions of a modern respiratory function laboratory.

[1] Based on an address given to a scientific session of the Faculty of Anæsthetists of the Royal Australasian College of Surgeons on April 9, 1960.

Blood Gases Versus Respiratory Work.

Most physicians and anæsthetists are familiar with normal arterial blood. The hæmoglobin is normally more than 94% saturated with oxygen; this is in equilibrium with the oxygen dissolved in the plasma at a partial pressure of about 100 mm. of mercury. The carbon dioxide present exerts a partial pressure of about 40 mm. of mercury. If either of these gas tensions is disturbed in the arterial blood, then gas exchange is abnormal whatever the mechanism may be. The only sure way to gauge the levels of oxygen and carbon dioxide in arterial blood is by appropriate analysis of a specimen of blood obtained by arterial puncture—a relatively simple and safe procedure. Comroe and Botelho (1947) have shown that only grosser degrees of arterial oxygen unsaturation can be recognized (as central cyanosis) with consistency and confidence by the average medical observer; and the clinical signs of carbon dioxide retention are inconstant, unpredictable and late in appearance.

Respiratory work represents a somewhat newer concept. In expanding and contracting the lungs and chest wall, physical work has to be done in a number of ways: (i) stretching the elastic tissue of lungs and chest wall; (ii) moving air through the airways; and (iii) overcoming friction as lung tissues move on each other. The last factor we can usually neglect. The first two are the important ones.

When the lungs move from a position of resting expiration to one of inspiration, the elastic tissue of the lungs and chest wall has to be stretched (Figure I*a*). A certain pressure has to be applied to stretch them a given amount. This relationship between pressure and volume we call the compliance. The sum of all the pressures multiplied by all the corresponding volumes gives us the work done in overcoming elastic resistance; in fact, it is proportional to the area of the triangle in Figure I*a*.

If the lungs are "stiffer" than normal because of fibrosis, infiltration or vascular engorgement, then for a given applied pressure the volume change will be less; that is, the lungs are less compliant than normal. We may represent the compliance behaviour of these lungs diagrammatically too (Figure I*b*). The work done in expanding them to the same extent as the normal lungs (represented by the area of the second triangle), is obviously very much greater than normal; that is, the person with stiff lungs will have to do an increased amount of respiratory work in order to achieve the same amount of expansion (and hence ventilation) of his lungs. If the elastic tissue of the lungs was decreased in amount, then we could imagine that the work of breathing for any level of ventilation would actually be decreased.

The second important type of work in respiration is that used to overcome the resistance of the airways to the flow of air. Consider an air space emptying through a normal-sized airway (Figure II*a*). A certain pressure (P) must be generated along the airway in order to bring about a given flow of air (F). The work which is done in moving this air is represented by the product of the pressure and the flow. Consider now an air space emptying through an abnormally narrow airway (Figure II*b*). To move the same flow of air along this narrower tube, a much greater pressure must be generated from one end of the airway to the other. Respiratory work necessary to overcome airway resistance is again represented by the product of pressure and flow. Pressure has to be very much increased, and so the respiratory work (pressure times flow) will also be very much increased.

We could express the same facts differently by saying that for a given increase in respiratory muscle work, there will be a smaller increase of ventilation in the second case than in the first. The importance of this approach will be apparent later.

Thus in a person with a stiff chest or lungs or with narrowed airways, the work involved in producing a

given level of ventilation (and hence of keeping the blood gases normal) will be increased, sometimes many times. A number of disturbances may threaten the normality of the blood gases. By means of increased respiratory work compensation may take place, but only at certain costs to the individual. The increased work will be reflected clinically by dyspnœa when the work load becomes obtrusively high; and indeed, our modern concepts of dyspnœa are based on this. Dyspnœa used to be explained by all sorts of formulæ connecting minute volume and maximum breathing capacity. We now believe that a person becomes dyspnœic (that is, conscious of the need for greater respiratory effort) when his work of breathing is greatly increased. It is not possible to fix an arbitrary level of respiratory muscle work at which dyspnœa will invariably occur. Dyspnœa is a subjective sensation, and, as with the sensation of pain, different people will vary

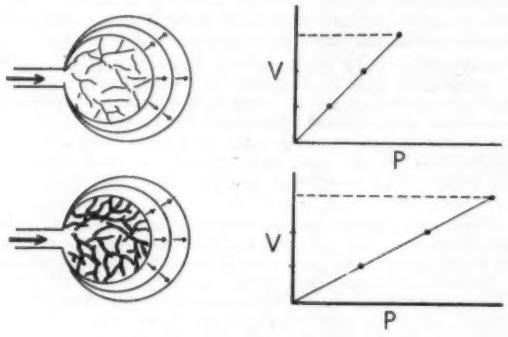

FIGURE I.

Diagrammatic representation of work done in overcoming elastic resistance of the lung. (*a*) Top: Lungs with normal amount of elastic tissue. Regular increments of applied pressure (P) cause regular increases of lung volume (V), as shown in the static pressure-volume diagram. The slope of the line represents the compliance of these lungs, and the area of the enclosed triangle is proportional to the work done in expanding them. (*b*) Bottom: Abnormally "stiff" lungs. A greater applied pressure is required to cause comparable increases in lung volume. The compliance is less than normal. The work done in expanding them to the same extent (area of enclosed triangle) is greatly increased. See text.

in their threshold of appreciation of the abnormal sensation. But the sensation is identical, and is produced by the same factors, whether it is felt by a healthy person who has indulged in strenuous effort or by a cardiac cripple who has climbed a single flight of stairs.

The interrelation between respiratory work and blood gases has several other important and interesting connotations.

In Figure III*a* we consider a normal subject and a patient with, say, emphysema and follow their oxygen consumption as they increase their ventilation. As the normal subject increases his minute ventilation, his oxygen consumption rises gradually. The emphysematous subject already has a higher than normal oxygen consumption owing to the increased work of breathing, and as he breathes still harder, the oxygen consumption rises disproportionately. One can imagine, indeed, that a stage might be reached at which the increased oxygen consumption was greater than the added amount of oxygen which can be delivered to the body by these increased respiratory efforts. In patients with emphysema this state of affairs sometimes exists. They cannot raise their arterial oxygen tension beyond a certain (low and fixed) level because of this limiting factor.

Figure III*b* represents what may happen with regard to carbon dioxide. In a normal subject increasing levels of ventilation wash additional carbon dioxide from the body through the lungs, and the carbon dioxide tension of the arterial blood falls. There comes a stage when no more can be washed from the body than is being produced by the tremendous respiratory efforts, and indeed even in a normal person the arterial carbon dioxide tension may start to rise again. In a person with profound airway disease, such as emphysema, this happens much earlier. In other words, at first increased ventilation of the lungs may wash out carbon dioxide to some extent; but as ventilation is increased even further, the excessive carbon dioxide production resulting from the greatly increased respiratory work more than counterbalances what can be washed out by the additional ventilation. Despite increased ventilatory efforts the arterial carbon dioxide level actually rises. In advanced emphysema, the patient may already be breathing at this optimum value, which in itself may be an abnormally high one. Any attempt to increase his ventilation and wash out carbon dioxide serves only to increase his arterial carbon dioxide tension.

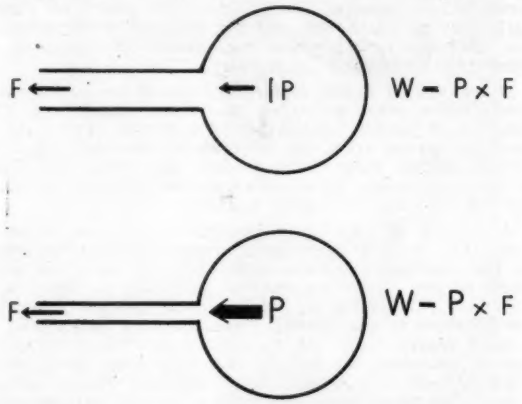

FIGURE II.

(*a*) Top: Air space emptying through normal airway. Work (W) required for given air flow (F) is proportional to product of pressure (P) and flow. (*b*) Bottom: Air space emptying through narrow airway. Great increase in pressure (P) required to produce same flow (F). Consequent increase in respiratory work. See text.

A further important aspect of respiratory work versus blood gases is seen in the patient with emphysema who develops carbon dioxide narcosis. Explanations of this condition usually begin from the hypothesis that in emphysema the respiratory centre becomes less sensitive to carbon dioxide. This statement is based on experiments such as those illustrated in Figure IV*a*. When a normal subject is given increasing concentrations of carbon dioxide to breathe, he progressively increases his ventilation by a certain amount. In a patient with emphysema the increases in ventilation are very much less, and this has been interpreted as indicating an insensitive respiratory centre.

However, when the increase of respiratory work is measured against increasing inspired carbon dioxide concentrations, a rather different picture emerges (Figure IV*b*). The patient with emphysema is seen to respond with an increase in respiratory work comparable with that of the normal subject. But we have already seen that in the presence of considerable airway obstruction a given increase in work will not produce a normal increase in ventilation, and so we would expect a smaller increase in ventilation in the abnormal subject. It is not a matter of a respiratory centre which becomes insensitive to carbon dioxide, and becomes sensitive to hypoxia. The work derived from a given carbon dioxide stimulus is simply not sufficient to keep up ventilation, and the normally available hypoxic stimulus becomes important as an adjuvant drive. Depression of this adjuvant drive by administration of pure oxygen may reduce ventilation still further and set up a vicious cycle of carbon dioxide retention.

Let us now go on to consider some of the levels in the process of respiration at which a breakdown of the normally competent mechanisms for transferring oxygen and carbon dioxide may occur.

Ventilation of the Lungs.

The first abnormal mechanism is a very familiar one—disturbance of the total ventilation of the lungs. Though familiar, it often goes unrecognized by the clinician, and indeed is often produced by physician, surgeon or anæsthetist. Respiratory centre depression and respiratory muscle paralysis may be manifestations of disease or manifestations of medical or anæsthetic interference. Loss of lung volume because of collapse, surgical resection or pleuro-pulmonary disease is an obvious cause. Airway obstruction or stiffening of the lungs will lead to a diminution in total pulmonary ventilation unless respiratory work is increased.

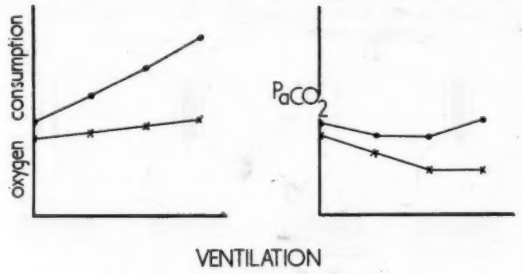

FIGURE III.

Effect of increasing ventilation as such on oxygen consumption and arterial carbon dioxide tension (P_aCO_2) in a normal subject (crosses) and in a patient with emphysema (dots). (Very diagrammatic.) (*a*) Left: In a patient with emphysema, oxygen consumption rises disproportionately with increasing ventilation because of the disproportionate increase in the work of breathing. (*b*) Right: In a normal subject, increasing ventilation causes a steady fall in P_aCO_2 until very high levels of ventilation are reached. In a patient with emphysema, P_aCO_2 may start to rise with modest levels of ventilation. See text.

In discussing this group, we are considering the simplest aspect of respiration—the bellows function of the lungs. Two aspects are of interest: what the bellows are doing, and what the bellows can do.

How do we assess the efficiency of total ventilation? Respiratory rate is only occasionally helpful. If it is, say, four or five per minute after a large dose of a hypnotic drug, then hypoventilation is likely. If it is about the normal rate or even very fast, it gives us no useful information. Minute volume may be measured by collecting the expired air over a given period of time. The tidal volume is minute volume divided by the respiratory rate. Part of the tidal volume, say 150 to 200 ml., is dead space ventilation, and the rest is alveolar ventilation, which is the crucial measurement. We could thus determine the approximate alveolar ventilation per minute in this somewhat indirect fashion.

A more direct way is to measure the arterial blood carbon dioxide tension, which is very sensitive to small changes in alveloar ventilation. It is a convention that if the arterial blood carbon dioxide tension is high, alveolar ventilation is not adequate in the individual patient. The patient with alveolar hypoventilation has a low oxygen saturation as well as a high arterial carbon dioxide tension. If he is given 100% oxygen to breathe, even a meagre level of alveolar ventilation will keep the alveolar oxygen tension quite high. The arterial blood will become fully saturated with oxygen again, but the hypercapnia is, of course, unaffected.

These measurements cover the current performance of the bellows. We are also interested in assessing what the bellows are capable of doing, in other words in assessing the potential over-all ventilatory function. Disturbances of this function are far and away the commonest initiating clinical cause of respiratory disability; and the common disability lies not in the bellows themselves, but in the connecting tubes. It is also fortunate that this function is among the easiest to assess. The simplest test, indeed, involves only the use of a recording spirometer with a fast-moving drum.

If a patient, after a maximum inspiration, expels his vital capacity as rapidly as possible into a recording spirometer, a tracing such as that of Figure V will be produced. A normal subject will expel over 70% of his vital capacity in the first second. A patient with one of the conditions leading to "stiff lungs" will have a small vital capacity, but will still expel over 70% of it in the first second. In the presence of significant airway obstruction the rate of expiration will be considerably reduced, and the patient will expel much less than 70% of his vital capacity in the first second. In a patient with emphysema, the shape of the forced expiratory volume (F.E.V.) curve will be little affected by inhalation of bronchodilators. The patient with significant asthmatic airway obstruction may show a dramatic improvement in the one-second F.E.V. ($F.E.V._{1\cdot0}$) following inhalation of a 1% concentration of neo-epinine.

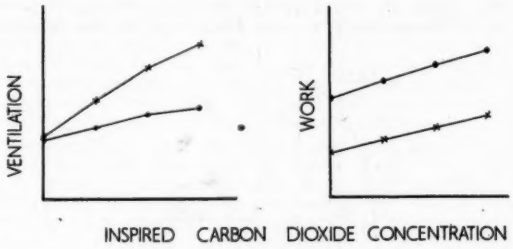

FIGURE IV.

Effect of increasing inspired carbon dioxide concentrations in a normal subject (crosses) and a patient with emphysema (dots). (Very diagrammatic.) (*a*) Left: Increasing the inspired carbon dioxide concentration in a normal subject causes a much greater increase in ventilation than it does in a patient with emphysema. This has been interpreted as indicating that the respiratory centre in emphysema is unresponsive to carbon dioxide. (*b*) Right: In terms of respiratory work, increasing carbon dioxide concentrations in inspired air cause a comparable response in the normal subject and in the patient with emphysema. See text.

Potential over-all ventilatory function used to be assessed by measurement of the maximum voluntary ventilation (M.V.V.) or maximum breathing capacity. This was a measure of the maximum volume of air which could be moved into and out of the lungs in one minute. It was a tiring procedure for the patient (and for the operator). It has been shown empirically that the $F.E.V._{1\cdot0}$ multiplied by a factor (35, 37 or 40 in different laboratories) gives an excellent estimate of the M.V.V.; and this indirect determination has largely replaced the older, more direct measurement. Reduction of the M.V.V. indicates reduction of potential ventilatory ability, and largely reflects functional airway obstruction.

Recently, a simple screening test has been introduced which is of some value in the field or in the out-patient department. The Wright Peak Flow Meter is a simple, portable instrument into which the patient makes a forcible expiration from the inspiratory position. A needle records the maximal expiratory flow rate (in litres per minute) directly on the dial of the instrument. A low maximal flow rate, in the absence of general weakness of the subject, points again to airway obstruction (that is, to asthma, bronchitis or emphysema).

At the full laboratory level, airway resistance may be measured as such in a number of ways. All the methods depend upon measuring driving pressure and resultant flow and expressing the airway resistance as a pressure-flow ratio.

Diffusion at the Alveolar-Capillary Membrane.

The second major breakdown point in respiratory function is interference with diffusion of gases at the alveolar-capillary membrane. In this context it must be remembered that oxygen and carbon dioxide behave very differently; carbon dioxide is many times more soluble than oxygen and so is far more freely diffusible. An alveolar-capillary membrane which is sufficiently thickened to interfere grossly with the diffusion of oxygen will have little or no effect on diffusion of carbon dioxide.

How may we measure the diffusing capacity of the lungs? Theoretically we are interested in the behaviour

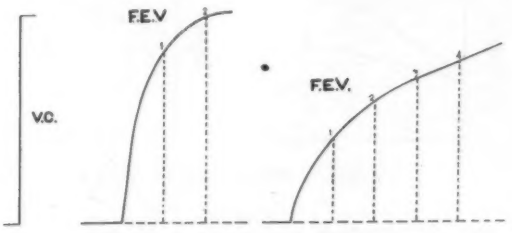

FIGURE V.

The vital capacity is represented by the height of the left-hand vertical line (V.C.). A normal subject expels his forced expiratory volume (F.E.V.) in the manner shown by the first curve—over 70% in the first second. A patient with abnormal airway obstruction expels his F.E.V. much more slowly, in the fashion of the second curve. The marked intervals represent periods of one second. See text.

of oxygen, but the diffusing capacity for oxygen is tedious and difficult to measure. We therefore use an unphysiological gas with similar behaviour characteristics to oxygen—namely, carbon monoxide. The patient inhales, either in one breath, or over a more prolonged period, air to which a minute concentration of carbon monoxide has been added, while we measure the amount of carbon monoxide taken up in the lungs per minute and the gradient of carbon monoxide tension between alveolus and capillary. The rate of carbon monoxide uptake in relation to the pressure gradient encouraging uptake is the diffusing capacity of the lung for carbon monoxide. From its value, we may infer the diffusing capacity for oxygen.

In conditions in which the alveolar-capillary membrane is thicker than normal, the diffusing capacity of the lung will be reduced to, say, half the normal level or even less. Causes of a thick alveolar-capillary membrane include diffuse interstitial pulmonary fibrosis, sarcoidosis, malignant infiltration of the lungs and some of the pneumonoconioses.

What are some of the other findings to be expected in a patient who has an alveolar-capillary diffusion block? We would expect to find the arterial oxygen saturation low. In practice it may be normal at rest, but may fall under conditions of mild exercise owing to the difficulty in getting increased amounts of oxygen from the alveolus to the capillary blood. The carbon dioxide tension of the arterial blood will, on the other hand, usually be normal, since diffusion of carbon dioxide is not significantly affected. Indeed, these patients commonly hyperventilate at rest, and the carbon dioxide tension of their arterial blood may be low. If such a patient is given 100% oxygen to breathe, it will create a very high oxygen tension in all the alveoli, and this will be more than sufficient to overcome the severest alveolar-capillary diffusion block. Arterial oxygen saturation will therefore return to normal after inhalation of 100% oxygen. These patients under usual conditions never develop carbon dioxide retention.

Since we measure the diffusing capacity of the lungs as a whole, the diffusing capacity will be reduced, not only by a thick alveolar-capillary membrane, but also by a reduction in the area of this membrane. It will, therefore, be apparent that in the presence of much lung destruction—for example, in severe bullous emphysema, or when lung has been removed surgically—the diffusing capacity may be regarded as a useful index of the amount of functioning pulmonary tissue remaining.

Ventilation-Blood Flow Relationships.

The third group of disturbances of respiratory function are those based on disturbances of the relative distribution of blood and air within the lung. This is the least well recognized group, but it is the commonest clinical cause of cyanosis and other disturbances of blood gases. The problem is best approached via a consideration of events in a single alveolus.

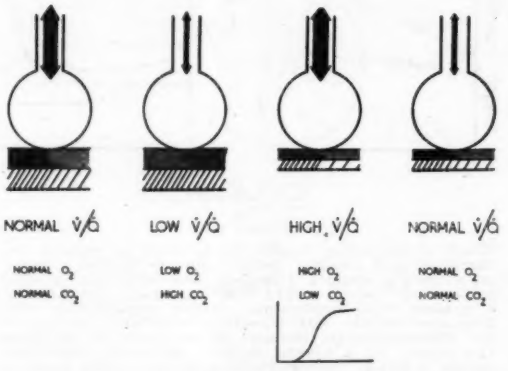

FIGURE VI.

Diagrammatic representation of the effect of changes in alveolar ventilation, alveolar blood flow and the $\dot{V}/\dot{Q}$ ratio on alveolar and arterial oxygen and carbon dioxide tensions. Oxygen tensions represented by shading, carbon dioxide tensions by cross-hatching. For explanation, see text.

Consider firstly what happens with regard to oxygen. Ventilation with fresh atmospheric air builds up the oxygen tension within the alveolus. Mixed venous blood reaches the pulmonary capillary with a low oxygen tension. Oxygen diffuses across the alveolar membrane, and by the end of the capillary the oxygen tension in alveolus and capillary is the same. In the case of carbon dioxide, the flow of blood brings it to the alveolus and ventilation washes it out of the lungs. Again the tensions are equal at the end of the capillary. Conventionally we represent the amount of alveolar ventilation by $\dot{V}_A$ and the amount of capillary blood flow by $\dot{Q}_C$. It will be apparent that some sort of balance must be maintained between ventilation on the one hand and blood flow on the other in all individual areas of the lung in order to maintain normal blood gas levels.

Figure VI illustrates diagrammatically what may happen to alveolar ventilation, alveolar blood flow and the $\dot{V}_A/\dot{Q}_C$ ratio in various alveoli.

The first alveolus has normal ventilation and normal blood flow, and hence a normal ratio between them. This will give us normal oxygen and carbon dioxide tensions in alveolus and capillary. If ventilation is pathologically reduced while blood flow remains normal (producing a low ventilation-blood flow ratio), oxygen will not be adequately replaced or carbon dioxide adequately removed (second alveolus). Oxygen tension in gas and blood will fall, and carbon dioxide tension will rise. If blood flow is reduced while ventilation remains normal, the ventilation-blood flow ratio will be high (third alveolus). The changes

in gas tensions will be as expected, high oxygen and low carbon dioxide tension. Though oxygen tension may rise a good deal, the arterial oxygen content and saturation will not rise proportionately, because of the shape of the oxyhæmoglobin dissociation curve. Thus, though this alveolus may compensate for the previous one so far as carbon dioxide is concerned (by blowing off excess of it), it cannot compensate for alveoli which do not provide an adequate amount of oxygen. Finally, if both ventilation and blood flow are proportionately reduced, the $\dot{V}_A/\dot{Q}_C$ ratio will remain the same as in the first alveolus, and so will the oxygen and carbon dioxide tensions (fourth alveolus).

It is possible to assess any unevenness of ventilation-blood flow ratios throughout the lung by several moderately sensitive methods. None of these are at present simple or routine ones. Using the respiratory mass spectrometer, one can get some idea of the range of ventilation-blood flow ratios throughout the lung, and of the ways in which ventilation and blood flow interact to produce this range of $\dot{V}_A/\dot{Q}_C$ ratios.

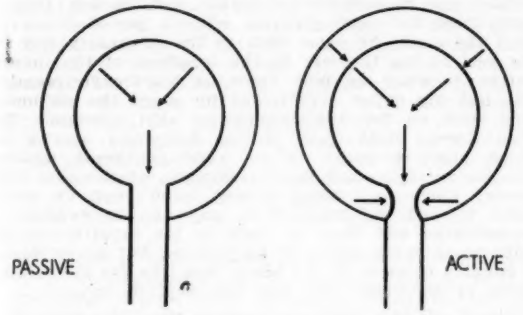

FIGURE VII.

Diagrammatic representation of events in passive and active expiration. (*a*) Left: In passive expiration, there is no compression of the smaller airways. (*b*) Right: In active expiration, the small airways may become grossly narrowed or even occluded. See text.

Ventilation-blood flow ratio inequalities are the commonest clinical cause of disturbances of blood gases. This is because such disturbances are particularly common in chronic airway disease and in emphysema. As far as the blood gases are concerned, the situation implies that oxygen tensions must be disturbed before carbon dioxide tensions. This is an important point, commonly overlooked by those who have become obsessed with carbon dioxide, and who think of carbon dioxide retention as the primary gaseous disturbance in emphysema. It may be firmly stated that a patient with emphysema, breathing room air, will not have carbon dioxide retention in the absence of hypoxia.

Local Airway Obstruction.

The important ventilation-blood flow ratio inequalities which give rise to changes in the blood gases depend largely on local changes in ventilation, and these are almost always the result of some form of airway obstruction.

Anæsthetists are very much more familiar than physicians with obstruction in the major airways. A major point is that, provided an orifice with a diameter of 1 cm. or so is present, no great functional disturbance is brought about, at least in comparison with the disturbance caused by obstruction of many small airways.

Obstruction of the small airways may be fairly uniform—the sort of picture we mentally visualize, perhaps wrongly, in bronchial asthma. If we measure the airway resistance in such cases, we shall find it greatly increased. However, if we allow time for equilibrium to occur, then the elasticity or compliance of the lung will be normal. If we find that the compliance of the lung is reduced—that is, if in response to a given applied pressure it expands less—then this is not simply a problem of uniform small airway narrowing. If the compliance is reduced in such circumstances, we may infer that a significant number of the small airways are not only narrowed, but completely obstructed. It is a not uncommon anæsthetic observation that an asthmatic patient may have lungs which are difficult to distend by the use of the usual positive pressure anæsthetic devices. The interpretation in these circumstances is that a number of the small airways are completely obstructed, and the reduced distensibility of the lung is a manifestation of the fact that less lung is being distended.

Much of this change may be due to the surface tension effects caused by the presence of small amounts of fluid in the lungs. Fundamental work on this factor has been done by Halmagyi and Colebatch in Sydney. They have shown that as little as 1 ml. per kilogram of body weight of fluid introduced into the trachea of unconscious sheep leads to profound hypoxia and a marked reduction in the distensibility of the lungs. The implications of their work should be of interest to practising anæsthetists.

Another closely related phenomenon has been demonstrated by Mead and his associates (1959). They have shown that if an experimental animal is anæsthetized and allowed to breathe spontaneously, or, having been curarized, is artifically ventilated only at its usual tidal volume, the compliance or distensibility of the lungs falls steadily and very significantly the longer the anæsthesia is continued. This fall in distensibility is not related to any mysterious thickening of alveolar walls or stiffening of the lungs under anæsthesia. It is again a manifestation that some areas of the lung have become completely collapsed, as has been clearly demonstrated in their related experiments. A few large inflations restored the distensibility of the lungs to normal in their animals.

Discussion.

These, then, are some causes of local complete obstruction to airways which may be particularly germane to the anæsthetist. Clinically the common patient with airway obstruction is the patient with chronic bronchitis and emphysema. Part of his airway obstruction is simple to understand: bronchi and bronchioles scarred, distorted, narrowed or even completely obliterated by chronic inflammation will obviously present a great obstruction to air flow. But at times the morbid anatomist has great difficulty in demonstrating the airway obstruction which, the physiologist maintains, was present during life. This is because the obstruction is a functional dynamic one rather than a fixed anatomical one.

When expiration is a passive event, the driving pressure to push air through the airways comes from the elastic recoil of the lungs (Figure VII*a*). This being so, no compressing pressure is applied to the smaller airways themselves. When expiration becomes active, the chest wall applies a pressure driving air out of the lungs. But this pressure is also applied to the small airways. It will tend to drive air from the air-spaces, but it will also tend to compress the small airways (Figure VII*b*). In a patient with chronic bronchitis and emphysema the small airways are diseased, and expiratory pressures which may be developed in an attempt to achieve greater flow rates may defeat their object by excessively deflating these smaller airways. It is indeed possible in emphysematous subjects to measure a maximum effective expiratory pressure beyond which the compressing effect on the airways is greater than the additional flow rate achieved. In other words, excessive respiratory efforts may again defeat their whole object.

Conclusion.

These, then, are the ways in which the fundamentally simple mechanisms of respiration may break down. The bellows may fail to function adequately, most commonly because there is something wrong with the connecting

tubes. Oxygen, having reached the alveoli, may fail to reach the capillary blood in adequate amounts because of an alveolar-capillary diffusion defect. Or there may be a problem of ventilation-blood flow imbalance—more simply stated, the air and the blood do not go to the same places. The normal organism above all strives to keep its blood gases within acceptable physiological limits. It will strive to do this in the face of one of these defects by calling upon the respiratory muscles to work harder. This increased work of breathing will at first compensate for most defects, but as time goes on only at the cost of dyspnœa of increasing severity. Eventually even increased respiratory work will not suffice to keep the blood gases normal, and the patient will have run the gamut from normal respiration through respiratory insufficiency to frank respiratory failure.

Acknowledgements.

In the concept of respiratory work versus blood gases I owe much to discussions with my colleague, Dr. H. J. H. Colebatch. Work in the respiratory laboratory of the Department of Medicine, University of Sydney, is supported by grants from the National Health and Medical Research Council, the Joint Coal Board of New South Wales, the Post-Graduate Medical Foundation, and the Consolidated Medical Research Fund of the University of Sydney. Miss J. A. Cozens prepared Figure V.

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THE SAVOUR AND THE SALT.[1]

By R. D. WRIGHT, M.S., D.Sc., F.R.A.C.P.,
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I SPEAK now in honour of Gordon Clunes McKay Mathison, a graduate of this school, a soldier of this country and an inspiration to all who knew him. He graduated in Melbourne in 1906 and died of wounds on Gallipoli in 1915. His memory remains bright in many places. I have heard people speak of him in country surgeries, in great hospitals and in London; he was remembered not only for his actual contribution to medical knowledge, but also for his rare quality of bright enthusiasm for mankind and for the knowledge of things. Charles Martin guided his path to physiology, but his quality was his own. He was of the salt of the earth and never lost his savour.

It was my good fortune to come to the School of Physiology in this University in 1939. Twenty-six years had passed since Mathison came back to found his school. The loss of men like Mathison in the first war and the progress of science had taught part of the necessary lessons. Production of medical graduates and research for the armed forces were now essential services. There were more uniformed than academic personnel in the department. For the Air Force the main investigations were on clothing and oxygen requirements for high altitude. Charles Martin had been an expert on temperature control, Mathison on anoxia. How Mathison would have revelled in the high altitude chamber—probably the most magnificent piece of research apparatus ever in the Medical School! Never before or since has there been a unit which cost so much. At the end of the war suitable arrangements could not be made to maintain it operational in peace-time. The salt lost some of its savour.

I was reminded of it one day in 1957; we were at dinner in University House when Sputnik's time came around on its second day up. It occurred to a few people in the whole dining-room to go outside and see something we would never see again for the first time. Sputnik went tumbling across the sky, and we knew a little how the untutored savage feels when he sees something quite outside his powers. A colleague summed it up by commenting that Russian science has the moon and we have the sixpence.

But you can get a lot for sixpence if you spend it well. And now I want to tell you of the fun my colleagues and I have had spending our sixpence. All of them have something of the pure joy of discovery that Mathison had. I will speak mainly of subjects; but first I will speak of a real successor to the man we honour tonight. George Reid came to the department in 1940. Like Mathison, he was a Queen's College man with an exacting sense of relevance. His first research job was the investigation of the pharmacologically active substances in the serum at the blood bank. He characterized the vasoconstrictor action and showed that it came from the blood platelets. After a period of service with the army, he came back to the laboratory and for the rest of his life was in the forefront of the investigation of what we now know as 5-hydroxytryptamine. His last big paper (1952) was for years the authoritative work on the pharmacology of that substance. But then George Reid died—during his army service his blood pressure began to rise and continued upward. Despite operation and other treatment, death came daily closer. When he noticed a new blind spot, he would come to find out whether it was due to exudate or hæmorrhage and then go back to his experiments. He understood every aspect of his disease, but never missed a possible moment at the bench. His was the indomitable spirit of Mathison—the salt had kept its savour.

George Reid's line of investigation stemmed from Charles Kellaway's studies of the substances liberated by tissue injury and the upsurge of interest in this subject associated with the visit of Wilhelm Feldberg to Melbourne. Everton Trethewie came to the department from these two masters. His first assignment was as physiologist with the Army team on war gases. It occurred to us that there were probable substances which could be antihistaminic—remember, this was in 1942 before there were antihistaminics. But we were unable to get any significant grant for this project. When these pharmacologics burst on the world, the salt had a bitter taste; the idea was a good one, but the sixpence was not enough. Trethewie has carried on investigating the liberation of histamine, the allergic reaction, and the effect on them of pharmacologics; he has studied the liberation of histamine in allergic processes and shown that salicylates and "Butazolidin" stop the allergic liberation of histamine.

Some time in the development of any research school there comes the question of formulating basic notions which become the basic requirements of any experimental programme. In our school, this phase came when the war was over and the students from the teaching classes started to come into the laboratory. Then the discussions of the teaching period became the basis of experimental planning. Each aspirant had a subject with which he was deeply intrigued. Should he become a cog in a large design of a master plan of investigation, or should he be encouraged to follow his own bent? Maybe it is a concomitant of the teaching approach, but I prefer to let the tree grow fairly free rather than to train it espalier. The savour of the individual mind is most distinctive when the branch is not over-pruned. In more developed countries, one could have directed the newcomer to a laboratory specializing in the field of his particular interest; but it is only in the last few years that this has become in any way possible in physiology in Australia.

Then, when a subject has been decided upon, what are to be the characteristic lines of the experiments? The first is that the question to be asked of the experimental material must be clear—for example, not where does œstradiol act to affect the pituitary, but does œstradiol

[1] The eighth Mathison Memorial Lecture, delivered at the University of Melbourne on October 13, 1959.

affect the pituitary directly, or via the hypothalamus, or via some other definite structure? Not how does the sodium depletion affect the adrenal, but does it affect it directly, or via the pituitary, or via the pineal?

When the question has been formulated, the experimental mammalian physiologist faces a highly organized animal, not much of which is directly accessible; the heart and lungs are deep in the chest, the nervous system is in the skull and vertebræ; the kidneys, adrenals and liver are deep in the abdomen. The urine is the only glandular product naturally accessible. How, then, is one to study the functioning of the various parts of the body? Harvey showed the use of acute vivisection, and this system has revealed many major phenomena; it demonstrated the power of direct observation of the organ concerned, but it was and always will be an organ functioning in a mutilated body and frequently itself mutilated. I do not suggest that this form of investigation is useless — indeed, I believe it to be indispensable; but it is limited in the transference of results directly to the intact conscious animal, and, after all, it is the processes in the intact conscious animal which we seek to understand. In order to exemplify the need for caution, I need only mention that Starling's law of the heart, derived from acute vivisection, has given way to the modern view that it is the greater emptying, not the greater dilatation, of the normal heart which accounts for the response to exercise. But I suggest that both views are correct, each in different circumstances, and occasionally combined.

And so, ever since Spallanzani investigated the digestion in the stomach of kites by causing them to swallow recoverable silver tubes containing food, the serious student of physiology has sought to ask the question directly at the site of action in the conscious animal. Toward the end of the last century, three great contributions to this attitude to investigation were developed. Einthoven initiated the valuable electrical indices of activity in the intact animal, Röntgen demonstrated the use of X-rays for this purpose, and Pavlov clearly enunciated the principle of surgical preparation of the experimental animal to allow access to information about function. I will refer to all three as they have been developed by my colleagues, but at the moment will elaborate on Pavlov's contribution. He had forerunners. Flourens and Magendie had initiated vivisection in the pre-anæsthetic and pre-Listerian era. That genius of Paris, Claude Bernard, had initiated many modern techniques and concepts — intermediary metabolism, cardiac catheterization, duct and organ fistulæ, enzyme chemistry. So when Pavlov set about a study of the work of the digestive glands, the origins of technique were well laid. He saw clearly the principle of surgical preparation for access for physiological research in the conscious animal; salivary fistulæ, gastric fistulæ and pancreatic fistulæ were conceived and established under full anæsthesia (remember 1847), antisepsis (remember 1867) and hæmostasis (remember Spencer Wells). It is one of the important experiences of a young researcher's life to follow Pavlov's thinking from the idea of ready access to information about the special organ, to the problem of depletion by exteriorization of secretions, to the principles of replacement therapy.

But his mind seized an essential point: the outpouring of the conscious dog's salivary secretion was not a simple matter of response to hunger and food. The whole situation of the dog in its environment was reflected in the functioning of a simple organ such as the salivary gland. He had broken the barriers of nineteenth century thinking in biology. Man ceased to be a mechanism suitably described in physico-chemical thermodynamic terms. The animal, surgically prepared for observation of the functional behaviour of individual parts while conscious and going about its multifarious business, brought the problem of psychological phenomena and their influence upon bodily mechanisms clearly into the open. This advance posed more clearly than any before the problem that we had not a calculus of organization. It was obvious that no phenomenon was fully explained until the sum of all the component organizations gave the right answer both qualitatively and quantitatively — Mill's doctrines of agreement and difference were still implicitly valid. Perhaps cybernetics has provided the organizational calculus for physiology, but I doubt it. It was based upon the common translation of Bernard's (1878) proposition *"la fixité du milieu intérieur est la condition pour la vie libre"*, and *"tous les mécanismes vitaux, quelque variés qu'ils soient, n'ont tojours qu'un but, celui de maintenir l'unité des conditions de la vie dans le milieu intérieur"*. It seems to me that *les mécanismes vitaux* were conceived by Bernard as internal regulations, and that he did not include in these *toutes les phénomènes de la vie*. Rosenbleuth and Wiener, in developing the propositions of cybernetics, formulated a mathematical interpretation of life processes as leading to stability. They overlooked the phenomena which the fond mother most deplores in her children — *les émotions fortes*. Anger and love-making, laughter and grief do not follow the rules of a negative feed-back system and stability for the individual; they are typified by a *crescendo* of activity leading to exhaustion of the mechanisms. They are of the very essence of positive feed-back. Philosophers who have been adapting the fixity principle to the general philosophy of behaviour would do well to consider these instability phenomena.

I shall deal now with some of the experiments developed in my school.

Direct Approach to Organs.

In the body there are glands — the ductless glands — which pour out into the blood hormones which affect other parts of the body. Some of these are activated by the nerves which supply them, but others are activated or inhibited by chemical substances which come to them. It is of the utmost importance to know how they are regulated. The usual method of investigation, apart from extirpation, is to inject a substance into the general veins of the body and see what influence it has. But when it has an influence by this route, you do not know whether it acted directly on the gland or somewhere else to produce another chemical substance which, in turn, may cause stimulation of a nerve or act directly on the gland.

When Dr. Sam Rose came to my laboratory in 1949 wanting to work on ductless glands, this question of point of action was soon obvious as a key problem in such research. He got certain effects on the pituitary gland by injecting adrenaline into the cerebro-spinal fluid, but we did not know whether it was acting on the pituitary or via the nervous system. With Mr. Jack Nelson (1955), he then devised a system which was obviously a great advance. The first stage of this was the realization that some plastic tubes could be drawn out to a thickness of one five-hundredth of an inch, and these could be put into such small organs as the pituitary gland of the rat. At first they were connected to motor-driven syringes, but that meant anchoring the rat in a small cage, which itself affects the rat's pituitary gland. Then they conceived the idea of an osmotic pump to be put under the skin of the rat with a three weeks' supply of chemical in the container. This was manufactured by Mr. L. Norton in our workshop and operates as follows: Congo red does not pass through "Cellophane" and attracts water. It was therefore put in a rubber bag with a metal and "Cellophane" stopper. This bag was put into a glass tube containing the drug substance, and over the metal stopper was put a rubber bag containing water. As the Congo red took up the water, the drug substance was expelled from the nipple of the glass reservoir, which had been connected to the plastic tube leading to the pituitary gland or any other organ. The speed of injection could be arranged by varying the size of the hole in the metal stopper and the thickness of the "Cellophane". So we could inject as little as one one-thousandth of a millilitre per day.

With this set-up, it was possible to show that the sex hormones act directly on the pituitary gland, that acetyl-

choline activates the pituitary gland, and so on. Just as we were getting under way, with the collaboration of Dr. Ray Bradley, to use this system on the investigation of cancer tissues, it proved impossible to get funds here to support Dr. Rose. Fortunately his work had been noticed very favourably in America, and he was invited to the National Institutes of Health in Washington. There he started a series of experiments early this year, which have given most promising preliminary results. Briefly, the idea is that the characteristics of cells are determined by the particular type of nucleic acid which they contain, and that cancer cells may arise from alteration of the composition of this nucleic acid. It is known that if one places some bacteria in solutions of appropriate nucleic acid, their characteristics will be changed by the influence of the nucleic acid which they take up from the solution, but this has never been demonstrated for animal cells. The long-term injector appeared to offer a real chance of doing so. In Washington Dr. Rose set up his animals with a malignant tumour of the thyroid in each eye. Into one eye the pump drove nucleic acid from a thyroid tumour of different type. After 14 days the original tumour had acquired characteristics from the second tumour.

This positive finding opens up vast possibilities for investigating the nature of the cancer process, and the Americans have invited Dr. Bradley to join Dr. Rose there to push ahead with a wide plan of investigation which we have worked out. If we, at this end, are unable to support such a programme, the Americans intend to follow it through. Their generosity and judgement in this problem have really given savour to the salt of scientific brotherhood.

Electrical Studies.

You will realize that the body consists of water and salts, simple and complex organic compounds. All these influence each other, and all activities of the body are the result of and produce changes in the balance of these. In so far as the body is a stable structure, the proportions are maintained; during activity and disease the proportions may change. Much of our work has been concerned with the behaviour of salts. In the body these are differentially distributed: potassium, magnesium and phosphate in the cells, sodium, calcium, chloride and bicarbonate outside the cells. During activity these distributions fluctuate, and because the salts are ionized, electrical events occur. So we have an index of the behaviour of the heart, the brain, muscles and glands. The whole electrical industry arose from Galvani's observations on electrical stimulation of frogs' legs by metals, and since that time this has been a tremendous field for the inquisitive biologist—it has, I am afraid, often given rise to over-simplification of explanation of biological phenomena.

In our department two workers have been the main contributors in this field. Dr. David Dewhurst took up the problem of the fundamental basis of bioelectrics. The principal features of these are voltage, resistance and capacitance. We have been working mainly on this. You will all recall experiments with Leyden jars, in which the capacitance may be called electronic and is due to two plates of conducting material being separated by a thin dielectric or non-conductor. Upon applying an electromagnetic field, charge builds up in such a system and distorts a rectangular pulse in a given way. Early, it was found that when a rectangular pulse was applied to tissues, there was the same sort of distortion as would be produced by the Leyden-jar type of capacitance. From this experience grew the notion that the surface of cells must have a Leyden-jar type of structure — Helmholtz's double layer — separated by some such dielectric as fat producing a high capacitance. As a result of Dr. Dewhurst's investigations, it appears likely that there may be another explanation.

If we take a solution of salt, it will contain positive and negative ions. If we separate one piece of solution from another by a membrane through which the ions pass more slowly than in the solution, when a current is passed from a battery, the ions will bank up on the two sides of the membrane — positive on one side, negative on the other. This gives the manifestations of capacitance and when finally worked out will be a substantial advance in our understanding of biological phenomena.

Another line of investigation of electrical phenomena has been Dr. E. R. Trethewie's investigation of the electrocardiogram. When Einthoven introduced this apparatus to clinical medicine, he chose the right and left arms and left foot as the points of pickup. You will readily appreciate that these are all in the one plane, but, of course, the heart is three-dimensional. Over the years various placings of electrodes have been devised to overcome the defects of the Einthoven leads, but none went back to essentials and worked out a system in which three planes at right angles were represented. Dr. Trethewie (1958) has done this, and finds that by using this system of three simple leads he detects precise electrical indices of disease in 15% more patients than does the commonly-used system. This discovery is now beyond doubt and of the utmost importance in clinical medicine, especially to the patient whose coronary thrombosis is only thereby detected and direct therapy immediately prevents the dangers of delay.

Other Ions.

I will deal briefly with four other investigations on ionic phenomena. Dr. E. M. Trautner and Dr. S. Gershon started a fundamental investigation of the effect of lithium ion on the body. This was important because Dr. John Cade, of the Victorian Department of Mental Hygiene, had shown that it had beneficial effects on some psychiatric patients. They showed that it had certain actions on the other ions of the body by displacing them and, with Dr. D. A. Coats, that the toxic effects it caused could be corrected by rational application of this knowledge. Thus, not only did the action of lithium become understood, but its use became much less dangerous.

Dr. M. Messer was working in Dr. Trautner's laboratory at this time on the metabolism of glutamine by the brain. In addition to elucidating the general character of this field, he made the important discovery that the concentration of such ions as sodium and potassium was critical to the stability of the systems concerned; and thus another window has been opened on the characteristics of the nervous system.

I am sure Bernard would have derived pleasure from the results of the experiments of Dr. W. T. Agar and his colleagues. They have shown that amino acids are selectively absorbed by the intestine, and that a side effect of some antibiotics is to interfere with this mechanism. Dr. Coats' studies on the secretory mechanisms of the parotid gland were also in the strict Bernard tradition.

In recent years there has been developed a series of ions similar to the fundamental complex of hæmoglobin. Dr. F. P. Dwyer, of the Australian National University, has been discovering a great variety of these and sending them to Dr. A. Shulman for investigation of their biological action. The results are not yet ready for publication, but it is clear that they will have a wide range of biological action and will be most important for investigating various systems. For example, certain types of these ions act like curare to block the neuro-muscular junction. We have found that it is not only the size, the fat solubility or the electric charge on the ion which makes it effective, but a combination of all three. By varying different ions, it will be possible to get very clear indices of the effectiveness of each characteristic.

Sodium Depletion and the Suprarenal.

And now I come to a piece of work on the salts in which it has been possible to push ahead with unusual speed for Australia. This is perhaps accidental. In any

experiment there is always the most suitable animal, and in this case it is the sheep. We have been able, therefore, to get assistance, not only from the University of Melbourne and the National Health and Medical Research Council funds, but also from the Wool Research Committee, the Rural Credits Fund and the Anti-Cancer Council. In this instance we hope to advance knowledge on basic aspects of hormonal control of ionic balance, and at one and the same time to further medical understanding of heart and kidney disease and the sheep farmer's understanding of how best to care for these animals. In research, as anywhere else, a good idea moves only as far as the available coin will carry it.

This research began in 1947, when Dr. D. A. Denton rang me up from the Royal Melbourne Hospital about the peculiar behaviour of the kidneys of a patient with a duodenal fistula. They were secreting chloride when the blood level was well below what is called the threshold. Our discussions led to satisfactory salt therapy for the patient and a theory that the kidney is a more subtle chemical regulator than current physiological theories suggest, and also to the conclusion that this phenomenon should be thoroughly investigated.

It was clear that the phenomenon was due to loss of sodium bicarbonate from the body. Where could we get an experimental animal from which we could drain sodium bicarbonate? Dr. Arthur Turner, of the Commonwealth Scientific and Industrial Research Organization, pointed out that the parotid gland of the sheep secretes it in large amounts, about half a gallon of saliva — that is, about 1·5 oz. of salt a day. With Dr. Victor Wynn and Dr. I. R. McDonald, we therefore set about making fistulæ first of the œsophagus and later of the parotid duct, so that the secretion could be drained outside the body. This reproduced the phenomena of the patient admirably and led to a lot of data of first-rate importance for the clinical management of patients with such losses. But it led to a rather exciting finding: we observed that, as the sodium was drained from the body, the sodium content of the saliva fell and the potassium content rose. This raised the question whether this change in salivary composition was due to activity of the suprarenal gland. Largely as a result of Dr. J. Goding's efforts, we demonstrated this to be the case by showing that it did not happen if the suprarenal glands were removed, but that it did occur if the electrolyte-active adrenal substitute DOCA was given to the adrenalectomized animal.

We had, therefore, a preparation in which we could put a graduated stress upon the adrenal gland. But the adrenal gland is situated deep in the abdominal cavity. It could be approached only under anæsthesia, and we had in mind the following conditions for valid investigation of the behaviour of such a gland.

1. All observations should be made on conscious, undisturbed animals in normal correspondence with their environment. It was shown by Verney (1947) that the normal hormonal mechanism regulating osmotic pressure is interfered with by anæsthesia or fright and, as we will recount, this is true also in the case of hormonal factors contributing to control of sodium balance. This places restrictions on the method of experimental approach, but solution of the problems by stage-by-stage surgery ultimately carries the advantage that the results derived are those holding for a normal animal.

2. The physiological stresses causing a response dependent upon the gland should be precisely defined and standardized, and be capable of graded variation.

3. The arterial blood supply of the endocrine gland under investigation should be exclusively accessible, so that the effect of supposed active agents can be tested by direct local injection.

4. The nerve supply of the gland, when relevant, should be acessible for stimulation or blocking.

5. The venous effluent exclusively from the gland should be accessible.

6. There should be one or more biological systems for quantitative assay of the activity of the venous effluent.

7. The chemical assay of the venous effluent must be developed until it detects quantitatively each substance known to be active on the biological indicator, and the over-all effect of these substances must correspond quantitatively to the action of the entire venous effluent.

How, then, could we get at the gland? Dr. Denton, Dr. Goding, Dr. McDonald and I had many a discussion about it, and no really satisfactory solution appeared possible until one morning Denton made the remark (more in hope than in anticipation, I think): "I don't suppose it could be transplanted to a loop in the neck." Twenty years ago that would not have been a very helpful remark; but with the advances in the surgery of the blood vessels it appeared eminently feasible. It is a good example of the endless frontier of research — a good idea can go only as far as existing technique can carry it. About three weeks later, Goding and I did the first transplant. The left adrenal was removed from the abdomen, and its artery was sewn into the side of the carotid artery and its vein into the side of the jugular vein and the whole wrapped into a tube of skin. It was done as an anatomical exercise on a somewhat dilapidated old sheep. We were all surprised that he survived, and perhaps more surprised when he survived the removal of his right adrenal gland a little later. Now we had our desiderata fulfilled. We had access to the blood supply of the only adrenal tissue in the body. Would he respond to sodium depletion? He did, in perfectly normal manner. Would he be adrenalectomized if we drained away the venous blood from the gland? When this was done, his reaction was that of adrenalectomy; this was proof that there was no supernumerary tissue.

Clearly here was a preparation of great potential value — we could fire our questions directly at the gland and get our answers out of the venous blood and the salivary gland. The first obvious question was, "how does the gland know that the animal is sodium depleted?" and the second, "what to do about it?".

For the present we will deal with the second question. As was indicated in the desiderata, one can use a biological index and/or a chemical index of the secretion from the gland. We decided to use both. The salivary increase in potassium content was shown, with certain corrections for secretion rate, to be proportional to the degree of sodium depletion. We did not have, at that time, any aldosterone, but the gland was shown to respond commensurately to DOCA. Fortunately we have been able recently to get aldosterone suitable for intravenous use, and the salivary gland gives a regular dose-response curve to the steady intravenous injection of authentic aldosterone. There is a latent interval of 60 to 90 minutes in the response, and this must be allowed for. The sensitivity of the parotid is enormous; as little as 5 μg. per hour gives a ratio decrease from 18 to 6.

Dr. McDonald and Miss M. Reich had undertaken the task of developing a chemical method for demonstrating aldosterone in the blood coming from the adrenal, and they have developed a technique which gives suitable sensitivity and accuracy for many of the experiments.

We are now in the position to state that the fall in sodium-potassium ratio of saliva is associated with increase in the aldosterone detected by this method in the adrenal venous blood only during sodium depletion, and that the other steroids do not show a variation associated with this. We are not yet in the position to state definitely that the diminution of detected aldosterone in the adrenal venous blood is a complete explanation of the salivary changes when the sodium level is restored to normal. With this slight qualification I will describe the experiments which have been done on the regulation of the gland.

The index of adrenal activity which has been used in these experiments is the change of composition of the saliva which is dependent upon the presence of the adrenal, and which, as was stated, is proportional to the amount of authentic aldosterone injected per unit time.

The first notion would obviously be that the concentration of sodium going to the adrenal gland might cause aldosterone secretion. Strongly suggestive evidence against this proposition is the fact that the salivary index was proportional to the degree of sodium depletion, no matter whether the blood sodium level had risen above normal or stayed normal as a result of concurrent water restriction. However, it was easy to inject into the carotid artery supplying only the adrenal transplant a glucose solution which lowered the sodium concentration going to the adrenal. There was no response to this. Subsequent experiments have shown that if the potassium level is raised when the sodium level is lowered, a response occurs. Similarly, if the adrenal is active because of sodium depletion, raising the sodium level in the blood of the gland does not reverse the activation; but if the sodium level at the gland is maintained during the development of depletion, activation does not occur. It is clear, therefore, that local variations in ion concentrations are significant in, but not sufficient explanation of, the state of activation of the gland during depletion and repletion.

As the transplanted gland is denervated, these results indicated that the stimulus acting on the adrenal was humoral. If current views that the pituitary was not the source of the stimulus to aldosterone secretion were correct, this would suggest a new hormone. We therefore carried out experiments in cross-circulation. The carotid artery of a sodium-depleted sheep was used to provide blood to the inactive transplanted adrenal of another sheep, and the venous outflow was fed back into the carotid of the adrenalectomized depleted sheep. The result showed that the adrenal had been activated by something in the blood. From infusion experiments it did not appear that this could be due to variation in salt or protein or erythrocyte content. Whence could the material concerned arise?

In considering whether there is a new hormone, there are four possible lines of evidence. From clinical and reported experimental evidence of pan-hypopituitarism, the pituitary appeared an unlikely source. Dr. McDonald performed complete hypophysectomy on a sheep, and it responded normally to salt depletion. Because, as we shall see later, the regulation by drinking is very precise, we considered the possibility that the hormone might arise from within the brain. We therefore set about a series of experiments involving removal of parts of the nervous system. In sheep with normal sodium balance, intercollicular decerebration or removal of the whole brain with hypophysectomy does not cause a salivary reaction. When the whole brain is removed from a sheep during full adrenal reaction to sodium depletion, in most sheep the reaction substantially keeps on and is not reversed by giving sodium to repletion. That the continuance of the activation depends upon the adrenal is demonstrated by its reversal by adrenalectomy. High mid-brain decerebration does not terminate the adrenal reaction to sodium depletion, and such preparations have responded to repletion.

It is thus clear that the response of the adrenal to sodium depletion is a complex affair involving local response to sodium-potassium levels, the nervous system, and some source of a stimulus to the glomerular zone of the adrenal which requires the nervous system to turn it off. The conditions for turning it on are not yet certain. This work has been fully reviewed by Denton, Goding and Wright (1959).

You will have noticed that, so far, we have been dealing with a mechanism which retains or allows the excretion of salts already in the body. A study of the sheep's ability to select the salt which will correct its losses has also been made. The sheep can select not only the right salt — for example, sodium as opposed to potassium and bicarbonate as opposed to chloride — but further than this, it can do simple multiplication — it takes twice as much of a half-strength solution. In passing, it may be noted that even sheep become highly annoyed if you go through the motions which, they have come to learn, promise correction of their depletion, but then give them only water. Such furious sheep recall the troubles of monarchs who imposed salt taxes.

Conclusion.

I have said enough to show that it is possible to carry out important researches in university departments in Australia. But this can be done only by expending enormous energy on providing the means to do it. In my own department we derive research funds from five official sources and a number of friends. On my left is the file of correspondence which I have had to handle to provide the grants for research in the last five years. On my right are the scientific papers which have been published as a result of the expenditure of them. I did think of having a third folder—the cheques of research workers for that time, but I could not justify the expense of providing you all with microscopes with which to see them.

It seems to me that Australia must face the question: Does it want universities which carry out the traditional functions of universities to teach and discover the truth as they see it, in science and the humanities? Of course, we all answer this with a resounding "yes", but the necessary actions are not being performed. The result of the Murray Committee report is that the student-staff ratio in the University of Melbourne has gone from 12·6 two years ago to 13·5 in 1959. The chores of academic life are becoming so great that most of my senior staff do not apply for professorships. I estimate that if universities were good places to work in, there would have been 15 applications for chairs by members of my staff in recent years. Only two applications were made. The days when it was the aim of the good academic to be a professor are gone — the young one knows that he will be regarded as an importunate mendicant who faces years and years of watching people going through the motions which should produce enough salt but never do. We are like the sheep with salt depletion to whom has been given a very dilute solution: if he tries to get enough salt he has to drink too much water; if he stops drinking water he does not get enough salt. In such circumstances the sheep makes a noise, and why do not the universities?

I think that this silence of the depleted results from some notion that university people should be impartial on all matters. Just because we must be impartial to arguments in our subjects is no reason why we should be impartial to bad treatment. For my part, I am completely partial to the idea that this country produces a magnificent crop of young minds, and that universities should have the facilities both in personnel and in material to give them all they can use. I am also completely partial to the idea that when they have graduated there should be adequate resources for the research-minded to make discoveries. At present, three of my best mature researchers are doing their research overseas, not because they want to do it overseas, but because there they are respected for their efforts and given facilities — not elaborate facilities, or luxurious salaries, but enough to get the work done. They were never given that here. They were given a low salary, which was annual tenure and might be stopped at three weeks' notice, and their modest applications for expenses were cut in half or even more seriously amputated, and they had no evidence that there was a serious attempt being made to get adequate resources for their purpose.

Their purpose was to make medical discoveries. When a man of quality feels that he is on the trail of discovery, there is an urgency to get on with it. There is a level of support which is essential. Nobody expects the impossible; but it should surely not be impossible

to have in Melbourne in 1959 facilities for experimental physiology equal to those provided in Czarist Leningrad 50 years ago. Nobody would expect here the financial conditions of scientists in Russia at the present time, but there is plenty of room between our provisions and their unlimited facilities. There is plenty of room between the national spirit which provided for the scientist to do all he can as quickly as he can, and the remark I once heard from a high official when confronted with a reasonable request from one of our greatest scientists who otherwise would accept an overseas appointment: "Bushranging", he said, "he can't get away with this sort of thing." He did not seem to see that the disgraceful aspect of the situation was that a conscientious scientist should be put in the position where it was necessary to expose himself to such a remark.

There is the utmost need to get a new sense of magnitudes in the national attitude to the universities. They are the places which train the chemists, physicists, biologists, lawyers, engineers, architects, musicians, school-teachers, dentists, agricultural scientists, and above all, the doctors for this community. They even train the staff of C.S.I.R.O. But somehow we have arrived at the position where a young doctor prepared, after years of study and expense, to work for a pittance, cannot get a hundred pounds for apparatus to set up in the corner of a bare laboratory. It has to be in the corner, because he usually shares the room with a number of others. Even at the level of defence, national ability will derive its greatest strength from research. National prestige, in these days, rests just as much on scientific research performance as on anything else.

In concluding this address, I want to pay tribute to my colleagues in the department. Those who have helped to carry the teaching load have been the backbone of the place. The secretarial and technical staff have carried an enormous burden. All I have described to you has resulted from joint efforts. There is much more which has been done which I have not had time to describe. I am especially grateful to the staff for accepting me as a co-worker; it must be very distracting to them when I come in and go out to lectures, committees, boards and deputations during the progress of an experiment. The fact that an almost impossible system does work is due to their dedication to their job. I sincerely hope that their faith in the future of this university and their science will be rewarded by a significant upturn in conditions — just occasionaly we would appreciate exchanging sackcloth and ashes for wool and salt.

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ACUTE CHLORAMPHENICOL POISONING IN THE NEW-BORN PERIOD.

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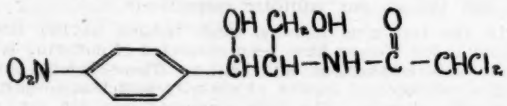
STREPTOMYCES VENEZUELÆ was isolated by Burkholder in 1947 from a soil sample collected in Venezuela; when grown in liquid media, this mould produced a substance of antibacterial effectiveness. From aerated submerged culture the antibiotic chloramphenicol was isolated, and by 1948 amounts sufficient for clinical use were being produced.

The drug, now produced synthetically, has the name D-(-)-threo-1-(*p*-nitrophenol)-2-dichloroacet-amido-1,3-propanediol, and the following structure:



It is unique among natural compounds, in that it contains a nitrobenzene moiety, and that it is a derivative of dichloroacetic acid.

Chloramphenicol is rapidly absorbed from the gut, significant plasma levels being found in 30 minutes. The peak plasma level is usually reached about 24 hours after an oral dose, and the highest levels usually achieved in adults range from 40 to 60 μg. per millilitre. More usual doses produce plasma levels of 20 to 40 μg. per millilitre. At peak plasma levels, about 60% of the drug is bound by plasma albumin.

The drug is rapidly eliminated from the body in adults; after single doses none can be detected in the blood after 12 to 18 hours. In adults, the drug is rapidly excreted in the urine, and over a 24-hour period 80% to 92% of an orally administered dose is excreted in the urine. The urine concentration is about 20 times that in the plasma when determined simultaneously, and in the urine 5% to 10% of the drug is in a biologically active form and the remainder, which is inactive, consists of an hydrolysis product of chloramphenicol and a conjugate of the antibiotic with glucuronic acid. The liver is a major site of degradation of chloramphenicol to these products.

A great deal of evidence suggests that the immature liver of the new-born baby, and especially of the premature new-born baby, is deficient in conjugation mechanisms. One evidence of this is to be found in metabolism of bilirubin in the new-born period; because of the difficulty of conjugation with glucuronic acid, "indirect" or unconjugated bilirubin accumulates in the blood-stream and may produce toxic effects, especially in the premature new-born baby.

This difficulty with conjugation makes it hard for the liver of the new-born baby to deal adequately with drugs requiring such conjugation for their degradation and subsequent elimination, and the drugs tend to accumulate much more readily than in more mature individuals, causing toxic effects because of the high blood levels resulting. Chloramphenicol is only one such drug.

Burns, Hodgman and Cass (1959) describe the effects of chloramphenicol on new-born premature infants. They had designed an experiment to see whether the prophylactic use of antibiotics would reduce mortality rates in premature infants who were born 24 hours or more after the membranes had ruptured. The infants were divided at random into the following four groups: (i) no antibiotics; (ii) chloramphenicol given by intramuscular injection in doses ranging from 100 to 165 mg. per kilogram of body weight per 24 hours; (iii) penicillin and streptomycin given by intramuscular injection; (iv) chloramphenicol given as in group (ii), plus penicillin and streptomycin as in group (iii).

There were approximately 30 infants in each group, and their birth weights varied from 1000 to 2500 grammes. Although it may not be correct to express results for such small groups in terms of percentages, the mortality rates for groups (i) and (ii) were only 18% and 19%, whereas the mortality rates for groups (ii) and (iv) were 60% and 68%. Since the only common factor was chloramphenicol, it is likely that this was the cause of the considerable increase in death rate.

When the deaths within these groups are dissected further, it becomes clear that the greatest differences are in the infants of high birth weight (2000 to 2500 grammes), in which the comparison of groups (ii) and (iv) with groups (i) and (iii) is even less favourable. This suggests that although many infants of very low birth weight would die whether they received the chlor-

amphenicol or not, many of higher birth weight would have survived but for the chloramphenicol.

Plasma chloramphenicol levels are recorded for two infants only, both of whom survived. The figures were 70 and 170 μg. per millilitre respectively.

In the last nine months, three infants at the Royal Hospital for Women have been suspected of suffering from acute chloramphenicol intoxication. These infants have had staphylococcal lesions of severity sufficient to justify antibiotic therapy. The dose employed was 100 mg. per kilogram of body weight per 24 hours, by the oral route. (This dose has now been reduced, for routine use, to 25 mg. per kilogram per 24 hours.) After three or four days of such therapy, the infants under notice have begun to deteriorate; there has been a little vomiting, disinclination to take feedings, lethargy and a change in colour to a greyish pallor. When chloramphenicol was withdrawn, spontaneous improvement occurred over 48 hours; thereafter there were no sequelæ.

Report of a Case.

A baby admitted recently to the Royal Alexandra Hospital for Children is regarded as having died from acute poisoning. The details are as follows:

A. was born on February 1, 1960, at a large obstetric hospital in Sydney. The pregnancy had been normal; the confinement was normal, although the labour was rather quick. The birth weight was 6 lb. 9 oz. As a new-born baby, he cried a lot, but appeared in good general health when discharged home on February 13. When he arrived home, his mother noted, on taking off his napkin, three "pimples" on each thigh underneath his napkin. Over the next few days many of these disappeared, but one lesion on the medial aspect of the left thigh increased in size and became red, hard and apparently tender. On February 18 the lesion was worse, and the temperature rose above normal. He was disinclined to take feedings, although he had been feeding well until that time. He was examined by his doctor and given an injection of 500 mg. of chloramphenicol; thereafter, because he did not take chloramphenicol well by mouth, he was given further injections of chloramphenicol at approximately twelve-hourly intervals in a dose of 500 mg. per injection for the total of four injections. At first he improved well, and on February 19 was feeding well and his temperature was normal. However, at about 10 a.m. on February 20, when the mother was washing the baby, he became white and cold, although rather blue around the lips and nose. His mother dressed him quickly and put him in a warm cot; then his colour improved, but it was noted that his breathing was irregular. He took but little of the 10 a.m. feeding. At 1 p.m. he vomited in his sleep and cried a little. He was taken out of his cot, his head was washed and he was changed, and he again became white and cold. On this occasion he did not improve when external warmth was applied, but by the time he was seen by his doctor his condition had clearly improved and was no longer very worrying. However, in view of the frightening history given by his mother, the doctor wisely had no hesitation in referring him to the Royal Alexandra Hospital for Children for admission.

On his admission to the hospital on February 20, at 4 p.m., the baby seemed in good general condition. His colour was good and he was warm; his temperature was 97·2° F. and his pulse rate was 136 per minute. His respirations numbered 24 per minute and were regular. However, two hours later the baby took only a very small feeding at 6 p.m. and subsequently became very cold and blue. When he was examined at this time he was grey, and no pulses could be found in the limbs. His heart rate was rapid at 180 per minute, and his respirations were rapid and irregular. The liver was considerably enlarged, being palpated three cm. below the subcostal margin. On the medial aspect of the left thigh was a suppurating, reddened, indurated lesion 1·5 cm. in diameter.

The differential diagnosis was considered to be either staphylococcal septicæmia due to a chloramphenicol-resistant organism or chloramphenicol intoxication. An intravenous infusion was commenced in order to administer erythromycin intravenously, and a blood sample was taken for assay of chloramphenicol. In spite of this therapy the baby's condition deteriorated progressively. Exsanguination-replacement transfusion was contemplated in order to remove some chloramphenicol, but the idea was rejected because of the moribund state of the baby. He died at 3.30 a.m. on February 21. No post-mortem examination of the baby was performed. Subsequently the level of chloramphenicol was found to be 160 μg. per millilitre of plasma.

Discussion.

Others, too, have been concerned about this problem. Sutherland (1959) has reported the deaths of three new-born infants while they were receiving high doses of chloramphenicol. Two of these infants received intramuscular injections, and one received chloramphenicol by the oral route alone. No blood levels were recorded.

Therapeutic blood levels are regarded as being in the range of 15 to 30 μg. per millilitre of plasma. When, in new-born infants, the level rises to 90 μg. per millilitre, the infant appears to be in danger; it may well be that danger exists below that level.

High blood levels of chloramphenicol are associated with a clinical state well described by Burns *et alii* (1959) and exemplified by the baby described in this paper. The state is characterized by the progressive development of vomiting, refusal to suck, respiratory distress, abdominal distension, periods of cyanosis, loose green stools, flaccidity, ashen colour and fall in body temperature. In fatal cases, death usually occurs on the fifth day of administration, but if the condition is recognized, the infant will recover spontaneously (if the situation has not deteriorated too far) in about 36 hours.

Conclusion.

It is recommended that, in the new-born period, the dose of chloramphenicol should not exceed 25 mg. per kilogram of body weight per 24 hours, except for diseases of extreme gravity, such as meningitis.

Summary.

The purpose of this report is to call attention to the possibility of acute poisoning being caused in new-born babies, and in particular premature new-born babies, by chloramphenicol. This is likely to happen when the total dosage of chloramphenicol in relation to body weight is high, and especially when chloramphenicol is given by injection rather than by the oral route. The reason why acute intoxication occurs in new-born babies and in premature babies at a dosage level which would not result in poisoning if the baby was older, appears to be related to difficulty in detoxication by the immature liver of the new-born infant and particularly the premature infant.

The clinical features of the intoxication are vomiting, refusal to suck, listlessness, respiratory distress, attacks of cyanosis, loose green stools, ashen-grey colour and fall in body temperature. Once this picture has developed the mortality rate is very high.

Acknowledgement.

Mr. David Dorman, microbiologist at the Royal Alexandra Hospital for Children, undertook the assay of chloramphenicol.

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Reviews.

A Functional Approach to Neuroanatomy. By Earl Lawrence House, Ph.D., and Ben Pansky, Ph.D.; 1960. New York, Toronto and London: McGraw-Hill Book Company, Inc. 10" x 7", pp. 504, with many illustrations. Price: Not stated.

THE nervous system is the stronghold of the anatomist, and there is a tendency on this account to make too much of it in the undergraduate medical course in anatomy. It is often honoured by the inclusion of a special class in neuro-anatomy, and many medical students come to think of the

brain as something infinitely complicated and special, holy ground upon which, for the rest of their lives, they will fear to tread. The authors of this book point out that in the modern curriculum there is little time to spend on such classes, and the student requires a clear concise textbook if he is to make anything of the subject.

It is therefore disappointing to find that the book they have written extends to 478 pages. Evolution, development and gross and microscopic anatomy occupy 132 pages, and most of the rest is taken up by chapters on the various motor and sensory systems. There are a useful clinical section, a brief atlas of sections of the base of the brain and a list of some 300 references at the end. The illustrations are all line drawings and diagrams by one of the authors; the quality is uneven, but the best are very good. The chapter on the functional components of the peripheral nerves is presented in tabular form and might well have been omitted. Some illustrations in this section are actively misleading to the inexperienced, such as those which depict (without explanation in the text) tests for the integrity of certain nerves. Some of the legends to these and other illustrations are also confused and confusing.

Much material is included which is of interest only to the neuroanatomist or neurophysiologist. There are, for example, 12 pages dealing with the nuclei of the thalamus, and the connexions of the subthalamic and hypothalamic regions are set out in great detail. There is little point in including in a "concise" book the details of Brodmann's classification. Again, even practising neurologists of the present day need know little of the uncinate bundle of Russell, the prerubral nucleus or the nucleus myoleioticus

This is a book which could be greatly improved by cutting; at present it is too long and detailed to recommend itself as a text for the student with limited time in which to study the nervous system.

Atlas of Anatomy and Surgical Approaches in Orthopædic Surgery—Upper Extremity. By Rodolfo Cosentino, M.D., with a Preface by Arthur Steindler; 1960. Illinois, U.S.A.: Charles C. Thomas, and Oxford: Blackwell Scientific Publications Ltd. 11" × 8½", pp. 208. Price: 84s. (English).

THIS is the first of three volumes, the other two of which are to be devoted to the lower extremity and to the neck and back respectively. The plan is simple, the upper extremity being considered by regions—shoulder, arm, elbow, forearm, wrist and hand. In each case the anatomy of the region is first shown in a series of photographs of dissections. Then the surgical approaches in orthopædic surgery of that region are illustrated systematically on a standard pattern: skin incision, X-ray picture of the region from the angle of approach, dissections to show that approach. There are no diagrams; illustration is entirely photographic. The excellence of the dissections, the first-class quality of the photography and the generally fine production make this a most useful and attractive book, which adheres to and fulfils the purpose indicated by its title.

Notes on Books.

The Year Book of General Surgery (1959-1960 Year Book Series). Edited by Michael E. De Bakey, B.S., M.D., M.S., 1959. Chicago: The Year Book Publishers Inc. Melbourne: W. Ramsay (Surgical) Limited. 7¾" × 5", pp. 640, with illustrations. Price: £4 8s. 0d.

IT is perhaps fitting that this Year Book should be edited by M. E. De Bakey, who is one of the leading American authorities in the field of cardio-vascular surgery, as this is at present one of the areas of most intense activity in surgical research and development. This year book provides an easy approach to the great number of papers being published in this field, and the chapters on the heart and on vascular surgery between them take up nearly a quarter of the whole volume; 10 years ago the chapter on the heart occupied a mere 15 pages. Other sections in which De Bakey notes increased interest and steady progress are the use of venous shunting procedures for the treatment of cirrhosis of the liver, and the field of homotransplantation of living tissue. This last is represented by abstracts of a mere six papers, but it is still a young subject, and its future development will be watched with great interest. The more specialized branches of surgery, including neurosurgery, maxillo-facial surgery and uro-genital surgery, are dealt with in other volumes of this series, but the broad field which remains is very adequately covered by the well-selected abstracts which make up the chapters of this book. A section on anæsthesia, edited by S. C. Cullen, includes some 70 abstracts arranged under the following headings: depressant drugs, ventilation, circulation, inhalation anæsthesia, relaxants, regional anæsthesia, spinal anæsthesia and miscellaneous.

The Year Book of Obstetrics and Gynecology (1959-1960 Year Book Series). Edited by J. P. Greenhill, B.S., M.D., F.A.C.S., F.I.C.S. (Honorary); 1959. Chicago: The Year Book Publishers Inc. Melbourne: W. Ramsay (Surgical) Limited. 7¾" × 5", pp. 574, with illustrations. Price: £4 8s. 0d.

THIS collection of abstracts from the current literature on obstetrics and gynæcology follows the same arrangement as its predecessors in the Year Book Series. That half of the volume devoted to obstetrics is divided into five chapters on the various aspects of pregnancy, five on the various aspects of labour, and one each on the puerperium and the new-born. The section on gynæcology includes chapters on infertility, operative gynæcology, infections, malignant tumours, menstrual disorders and endocrinology. There is also a short report of a conference on "The Uterus" held by the New York Academy of Science in 1958; this report is a synopsis of the published proceedings. The abstracts in this volume are freely interspersed with useful editorial comments, and, as is usual with these volumes, it provides excellent coverage of literature on obstetrics and gynæcology published during the year under review.

The Year Book of Pediatrics (1959-1960 Year Book Series). Edited by Sydney S. Gellis, M.D.; 1959. Chicago: The Year Book Publishers Inc. Melbourne: W. Ramsay (Surgical) Limited. 7¾" × 5", pp. 494, with illustrations. Price: £4 8s. 0d.

THE arrangement of this Year Book follows strictly that of its predecessor. The abstracts arranged in its chapters provide a very adequate coverage of the more important papers published in pædiatrics during the year under review. These are annotated by frequent editorial comments; some of these are by the editor, but many are contributed by authorities to whom the papers have been submitted, or in some cases by the authors themselves. These annotations are therefore a particularly valuable feature in this Year Book, which is a most useful source of information on current topics for all interested in children's diseases; this must include most general practitioners.

The Year Book of Pathology and Clinical Pathology (1959-1960 Year Book Series). Edited by William B. Wartman, B.S., M.D.; 1960. Chicago: The Year Book Publishers and Melbourne: W. Ramsay (Surgical) Limited. 7¾" × 5", pp. 456 with illustrations. Price: £4 19s.

IN his introduction to the present Year Book, Dr. Wartman presents a racy survey of the progress of pathology during the past decade, in the form of a series of reflections prompted by leafing through the pages of the last 10 volumes. A special article on "Fashions in Cancer Research" by Robert Schrek makes instructive reading. The general plan of the rest of the book follows the usual pattern with a flexibility which allows the most effective grouping of the material presented. The volume is pervaded throughout by Dr. Wartman's deftness of touch; this makes it a pleasure to browse through this most informative of Year Books, which is an annual reminder of how much the pathologist has to teach in the field of clinical medicine.

The Year Book of Dermatology (1959-1960 Year Book Series). Edited by Rudolf L. Baer, M.D., and Victor H. Witten, M.D.; 1960. Chicago: The Year Book Publishers. 7¾" × 5", pp. 480 with illustrations. Price: £4 19s.

THE omission of the word "Syphilology" from the title of this Year Book is a break with a time-honoured tradition, but is a realistic admission of the fact that syphilis is no longer, as it once was, a major part of the dermatologist's practice, but is now just one disease among many that have to be considered in the differential diagnosis of skin conditions. However, the editors are careful to point out that the omission does not mean that dermatologists have lost interest in syphilis or have any intention of relinquishing responsibility for its diagnosis and treatment. Nevertheless, the chapter on "Venereal Diseases Other than Gonorrhœa" is one of the shortest in the book and contains abstracts of only seven papers.

Though all "Year Books" are collections of abstracts of publications in their own particular field, each is imprinted with its own characteristics by the style and approach of its editor or editors. An important and valuable feature of the present Year Book has for some years been the review chapter on some selected topic with which it opens. This year Baer and Witten have chosen acne vulgaris as their subject, and have devoted 25 pages to a discussion of recent advances in the knowledge and management of acne, with a full bibliography. The abstracts which make up the remainder of the volume are arranged in the usual 14 chapters and are interspersed with useful editorial comments.

The Medical Annual: A Year Book of Treatment and Practitioners' Index. Edited by R. Bodley Scott, M.A., D.M., F.R.C.P., and R. Milnes Walker, M.S., F.R.C.S.; seventy-fifth year; 1959. Bristol: John Wright and Sons Limited. Toronto: The Macmillan Co. of Canada Ltd. 8¼" × 5¼", pp. 655, with illustrations. Price: not stated.

IN the seventy-seventh number of "The Medical Annual", the editors follow the revised arrangement of the contents adopted in the previous volume. It is noted that Sir Henry Tidy has retired from the position as joint editor of the annual, and his place has been taken by Dr. R. Bodley Scott. The contents include five special articles: "New Sex Hormone Preparations", by P. M. F. Bishop; "Cancer Research", by A. Haddow; "Cross Infection in the Ward", by R. H. Shooter, "Emphysema", by T. Simpson; and "Fluid and Electrolyte Balance in Practice", by A. W. Wilkinson. The main body of the volume consists of reviews of the year's work, each chapter contributed by a specialist in the appropriate branch, with lists of references to the papers discussed at the end of each subsection. "The Medical Annual" must be one of the oldest of the several annual publications which aim to keep the practitioner up to date with his subject, and it continues to fill a very useful role in this regard.

Books Received.

[The mention of a book in this column does not imply that no review will appear in a subsequent issue.]

"Principles of Bone X-Ray Diagnosis", by George Simon, M.D., M.R.C.P., F.F.R.; 1960. London: Butterworth & Co. (Publishers) Ltd. 10¼" × 8¼", pp 204, with many illustrations. Price: 78s. 6d.

"Surgical Aspects of Medicine", edited by H. Daintree Johnson, M.A., M.B., B.Chir., F.R.C.S.; 1959. London: Butterworth & Co. (Publishers) Ltd 9¼" × 6¼", pp. 404. Price: 90s. (English).

"The Clinical Use of the Revised Bender-Gestalt Test", by Max L. Hutt and Gerald J. Briskin; 1960. New York and London: Grune & Stratton. 9" × 6", pp. 176, with illustrations. Price: $5.00.

"Official Year Book of the Commonwealth of Australia, No. 46", prepared under instructions from The Right Honourable the Treasurer by S. R. Carver; 1960. Canberra: Commonwealth Bureau of Census and Statistics. 9" × 6", pp. 1304, with maps. Price: Not stated.

"The Influenza Epidemic in England and Wales 1957-1958", Ministry of Health Reports on Public Health and Medical Subjects, No. 100; 1960. London: Her Majesty's Stationery Office. 9¼" × 6", pp. 76. Price: 4s. 6d. (English).

"Rubella and other Virus Infections during Pregnancy", Ministry of Health Reports on Public Health and Medical Subjects, No. 101; 1960. London: Her Majesty's Stationery Office. 9¼" × 6", pp. 108. Price: 7s. 0d. net (English).

"The Developmental Progress of Infants and Young Children", Ministry of Health Reports on Public Health and Medical Subjects, No. 102; 1960. London: H.M. Stationery Office. 9¼" × 6", pp. 16. Price: 1s. 3d. net (English).

"Cancer of the Rectum", edited by Cuthbert E. Dukes, O.B.E., M.D., M.Sc., F.R.C.S.; "Neoplastic Disease at Various Sites", Volume III, edited by D. W. Smithers, M.D., F.R.C.P., F.F.R.; 1960. Edinburgh and London: E. & S. Livingstone. 9½" × 6¼", pp. 320, with illustrations. Price: 50s. net (English).

"Tools of Biological Research", edited by Hedley J. B. Atkins; Second Series; 1960. Oxford: Blackwell Scientific Publications. 8¾" × 5¾", pp. 192, with illustrations. Price: 37s. 6d. (English).

"Essentials of Medicine" for Dental Students", by A. C. Kennedy, M.D., M.R.C.P.E., F.R.F.P.S.; 1960. Edinburgh and London: E. & S. Livingstone Ltd. 8¼" × 5¼", pp. 280, with illustrations. Price: 25s. net (English).

"A Study of Home Accidents in Aberdeen: An Investigation Financed by the Nuffield Provincial Hospitals Trust", by Ian A. G. Macqueen, M.A., M.D., D.P.H., F.R.S.H.; 1960. Edinburgh and London: E. & S. Livingstone Ltd. 8¼" × 5¼", pp. 108. Price: 12s. 6d. net (English).

"Chemicals in Food and Farm Produce: Their Harmful Effects", by Franklin Bicknell, D.M., Oxon.; 1960. London: Faber and Faber. 7¼" × 5", pp. 192. Price: 12s. 6d. net (English).

"Tumors of the Odontogenic Apparatus and Jaws", by Joseph L. Bernier, D.D.S., M.S., F.D.S., R.C.S., England; "Atlas of Tumor Pathology", Section IV, Fascicle 10a; 1960. Washington: Armed Forces Institute of Pathology. 10¼" × 8", pp. 112, with many illustrations. Price: $1.00.

"Socrates on the Health Service: Dialogues of Today", from *The Lancet*; 1960. London: The Lancet Ltd. 8¼" × 5¼", pp. 102. Price: 5s. (English).

"General Anæsthesia", Volumes 1 and 2, edited by Frankis T. Evans, M.B., B.S., F.F.A.R.C.S., D.A., and Cecil Gray, M.D., F.F.A.R.C.S., D.A.; 1959. London: Butterworth & Co. (Publishers) Ltd. 9¾" × 6¼", pp. 574, with illustrations. Price: £9 18s. 0d.

"The Adrenal Circulation", by R. G. Harrison, M.A., D.M., and M. J. Hoey, B.Sc.; 1960. Oxford: Blackwell Scientific Publications. 9¾" × 7¼", pp. 86, with illustrations. Price: 25s. (English).

"Illustrating Medicine and Surgery", by Margaret C. McLarty, D.A. (Edin.); 1960. Edinburgh and London: E. & S. Livingstone Ltd. 9¾" × 7¼", pp. 168, with many illustrations. Price: 37s. 6d. net (English).

"Atlas of Medical Mycology", by Emma Sadler Moss, B.S., B.M., M.D., and Albert Louis McQuown, B.S., B.M., M.D.; Second edition; 1960. Baltimore: Williams & Wilkins Co. 10" × 6¾", pp. 348, with many illustrations. Price: £6 1s. 0d.

"Prenatal Care: The Collected Papers and Discussions Presented at the Symposium Held at Groningen-Rotterdam, June 1-6, 1959"; 1960. Groningen: P. Noordhoff Ltd. 9¼" × 6¾", pp. 484, with 152 figures, 91 tables and 6 graphs. Price: $7.50.

"Fundamental Aspects of Normal and Malignant Growth", edited by Wiktor W. Nowinski; 1960. Amsterdam, London, New York and Princeton: Elsevier Publishing Company; London: D. Van Nostrand Company Ltd. 9¼" × 6¼", pp. 1042. Price: £10 10s. 0d. (English).

"The Psychology of Deafness: Sensory Deprivation, Learning, and Adjustment", by Helmer R. Myklebust; 1960. New York and London: Grune & Stratton. 6" × 9", pp. 406. Price: not stated.

"Good English for Medical Writers", by Ffrangcon Roberts, M.A., M.D., F.F.R.; 1960. London: William Heinemann Medical Books Ltd. 8¼" × 5¼", pp. 190. Price: 17s. 6d. (English).

"The Ear, Nose and Throat Diseases of Children", by J. F. Birrell, M.D., F.R.C.S.E.; 1960. London: Cassell & Company Ltd. 8¾" × 5¾", pp. 394, with illustrations. Price: 50s. net (English).

"Clinical Psychiatry", by W. Mayer-Gross, M.D. (Heidelberg), F.R.C.P. (Lond.), Eliot Slater, M.A., M.D. (Camb.), F.R.C.P. (Lond.) and Martin Roth, M.D. (Lond.), F.R.C.P. (Lond.), D.P.M.; Second edition; 1960. 9¾" × 7¼", pp. 724. Price: 63s. net (English).

"Chromatographic and Electrophoretic Techniques", edited by Ivor Smith, B.Sc., Ph.D., F.R.I.C.; Volume 1, "Chromatography", Volume 2, "Zone Electrophoresis", 1960. London: William Heinemann Medical Books Ltd. 8¼" × 5¼", pp. 860, with illustrations. Price: 30s. net. (English).

"Modern Hygiene for Nurses: Including Bacteriology and the Principles of Asepsis", by M. A. Priest; 1960. London: William Heinemann Medical Books Limited. 8¼" × 5¼", pp. 220. Price: 15s. net (English).

"Dilling's Clinical Pharmacology", revised by Stanley Alstead, C.B.E., M.D., F.R.F.P.S. (Lond.), F.R.C.P. (Edin.), F.R.S. (Edin.); Twentieth edition; 1960. London: Cassell & Company Ltd. 7¼" × 5", pp. 876. Price: 30s. net (English.)

"From Girlhood to Womanhood", by Albert Sharman, M.D., D.Sc., F.R.C.O.G.; 1960. Edinburgh and London: E. & S. Livingstone Ltd. 7¼" × 4¾", pp. 80. Price: 6s. net (English).

"The Clinical Apprentice: A Handbook of Bedside Methods", by John M. Naish, M.D. (Cantab.), F.R.C.P., and John Apley, M.D. (Lond.), F.R.C.P.; 1960. Bristol: John Wright and Sons Ltd. 7¼" × 4¾", pp. 208, with illustrations. Price: 12s. 6d. (English).

The Medical Journal of Australia

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WHITHER GENERAL PRACTICE?

GENERAL PRACTICE is changing. The changes are less in Australia than in most other countries, perhaps less than in any other country, but they are occurring. The principal influences in Australia preserving our heritage or retarding our progress (according to the individual point of view) are perhaps our relative isolation and our conservative national character. But the forces of social change are strong throughout the world, and for good or ill we cannot escape them indefinitely. They are playing and will play a significant part in shaping medical practice, and no part of it more than general practice; so it is wise that those who understand medicine from within should take note of what is happening elsewhere, as well as in Australia, and should not only anticipate but contribute actively to the shaping of change.

The change overseas is great and will surprise, even shock, those who have not followed its evolution. So shrewd and informed an observer as T. F. Fox,[1] Editor of *The Lancet*, who knows the position at first hand in the United Kingdom, Russia, the United States and elsewhere in the Northern Hemisphere, states laconically that, except in isolated places, the general practitioner is already extinct. He has not of course visited Australia, but maybe he included it in the "isolated places". Perhaps the survival of the Australian general practitioner is comparable to that of the marsupial in evolutionary development, and he may even look forward to becoming a tourist attraction like the koala or the kangaroo.

It is important, of course, not to misunderstand Fox's point. When he refers to the general practitioner, he means just that—"doctors who do virtually everything that has to be done for their patients". But all over the world, he writes, the lights are going out on that kind of general practice. "Proper and necessary in an isolated countryside, it is improper and unnecessary where the patient with a difficult disorder can have this treated by a specialist." At the same time Fox suggests that, even if the general practitioner's field of operations is considerably restricted, perhaps his residue of activities includes something enormously worth doing which no hospital or specialist group can do so well—to wit, the giving of good personal care. Looking around for a term to replace "general practitioner" Fox reluctantly discards "family doctor", not because he does not like the term, "with its friendly warmth", but because his experience in England and America is that few people in fact have a family practitioner—the description represents an aspiration rather than a fact. The term he settles on is "personal doctor", thinking of someone whose essential characteristic is that he is looking after people as people and not as problems, someone whose function is to meet what is really the primary medical need.

> A person in difficulties wants in the first place the help of another person on whom he can rely as a friend—someone with knowledge of what is feasible and also with good judgement of what is desirable in the particular circumstances, and an understanding of what the circumstances are. The more complex medicine becomes, the stronger are the reasons why everyone should have a personal doctor who will take continuous responsibility for him, and, knowing how he lives, will keep things in proportion—protecting him, if need be, from the zealous specialist.

This is no downgrading, though it does imply a good deal of change. Fox is quite clear that the personal doctor is "of no use unless he is good enough to justify his independent status". He comments: "If (like many unqualified healers) he has a therapeutic personality, that will be a great help; but in any case he needs to have the knowledge that comes of a continuing interest in medicine, together with trained and critical judgement."

There is much more that we might refer to in Fox's article, which is long, meaty and delightfully written, warranting careful study by all who are interested. For present purposes it is enough to indicate his stress on the personal doctor idea, which is of course quite compatible with the family doctor idea when circumstances allow the wider term. In this regard we may note the comments of Harvey Flack,[2] Editor of *Family Doctor*, on the suggestion that there has been a change in the attitude of many patients to their doctor, so that he seems to be just another tradesman. Flack judges that this is not so from the considerable mail received from readers of *Family Doctor* "who think highly of their own family doctor but worry because he does not give enough explanation and simple reassurance". Referring to a description in one letter of a doctor who did take the trouble to explain things, "a new doctor in their district whom they trusted and liked", Flack remarks: "And I think that is a good definition of a family doctor. Someone who is trusted because of his knowledge and skill and liked because he takes time to explain and reassure."

Here is a picture of things that warrants hard and honest thought. The idea of the personal doctor is of course not new. Nobody, least of all Fox or Flack, would suggest that for a moment. It is one of the oldest and most important concepts in medical practice as we know it, and it is understood and followed by all really good doctors, especially the best type of general practitioners. The provocative part of the picture is the emphasis it gives, away from a wide range of activity and medical service, to what amounts to specialized attention to the person of the patient. It is not undermining the position of the present general practitioner, or underrating his ability, to suggest that the increasing complexity of medicine creates great difficulty in providing full general practitioner service as it has been known in the past.

[1] *Lancet*, 1960, 1: 743 (April 2).

[2] *Practitioner*, 1960, 184: 643 (May).

It is not boasting—or being original—to say that the standard of general practice in Australia is probably unexcelled anywhere, and the tradition is one to be maintained. Moreover, it is still necessary in some parts of Australia for general practitioners to undertake aspects of the medical and surgical care of their patients that, in theory at least, might better be in the hands of specialists; and, at least until a better way is devised for dealing with these situations, the general practitioner who accepts the onus of isolated country practice should be given the facilities and opportunity to equip himself for all responsibilities. We have already had our say on more than one occasion about what appears to be the realistic view of surgery in country general practice, and both surgical and medical emergency of a major character can still be thrust on the isolated doctor despite all the splendid developments in flying doctor and ambulance services. More than that, it is by no means always feasible, for personal or economic reasons, for patients to travel to large centres, or for specialists to go to country centres, and hardship may ensue if this is inescapable. For these reasons, the true general practitioner, with the marsupial, may survive for a long time in parts of our isolated island continent, whatever may happen elsewhere. For the rest, the thoughful Australian general practitioner may yet find that his true status would be best maintained, even raised, by a narrowing of activity and a clarification of aim till personal medical care becomes his essential role. Perhaps, to return to Fox's line of thought, in reversal of our present procedure, we might be better in future to select the personal doctors and let everybody else be a specialist. "Besides techniques, the personal doctor should have character, much knowledge, many interests, and, above all, a capacity for identifying himself with his patient." For, as Fox says, call it what you like, this is no easy role.

Current Comment.

TUMOUR CELLS IN THE BLOOD: AN EXPERIMENT.

THE occurrence of tumour cells in the blood-stream is a subject which has recently been receiving considerable attention in the medical literature. Some writers have questioned the validity of some published claims, or have dismissed the subject as being one of purely academic interest. In the light of this debate a short paper recently emanating from the Mayo Clinic appears to be of particular interest. In this, F. A. Peterson and three colleagues[1] report the results of experiments performed on an adult Great Dane dog which was found to be suffering from a spontaneous osteogenic sarcoma of the tibia. Specimens for biopsy were taken below a tourniquet on two separate occasions about one week apart. On each occasion a specimen of peripheral blood was taken before application of the tourniquet and again (from the femoral vein draining the affected limb) about 20 seconds after release of the tourniquet. All specimens were carefully examined for neoplastic cells by a modification of the method of Sandberg and Moore, and on both occasions the results were the same. No tumour cells could be found in the specimen taken before the tourniquet was applied, and tumour cells were isolated from the specimen taken after release of the tourniquet. To confirm their identification, these cells were compared with touch-smear preparations made directly from the biopsy specimens. The authors of this paper admit the possibility that the application of a tourniquet for 15 minutes could of itself have increased the concentration of tumour cells in the blood of the occluded limb by pooling those cells which might have embolized during this period. Nevertheless, this simple experiment seems to us one of the clearest demonstrations of which we have yet read that tumour cells probably were spilled into the blood-stream by the trauma of the biopsy operations, and that the cells recovered really were tumour cells (a point questioned by some commentators).

To illustrate the clinical application of this experiment, Peterson and his colleagues add a brief case report, the essential details of which are as follows:

> A young man was admitted to hospital complaining of cramping pains in his right thigh for the previous six weeks. For these "cramps" he had received several manipulative treatments, during the last of which he had heard a sharp snap. X-ray examination revealed a pathological fracture through a tumour of the shaft of the right femur. The following day a biopsy specimen was taken distal to a tourniquet, and the limb was removed without disturbance of the tourniquet, as soon as the result of biopsy was known. Blood from the amputated limb was found to contain numerous neoplastic cells. The patient made a good immediate recovery, but died from widespread metastases of an osteogenic sarcoma several months later.

Peterson and his colleagues quote this case as illustrating the role which non-surgical trauma may play in disseminating tumour cells into the circulating blood. They state that in their opinion biopsy of malignant tumours of the extremities should be performed distal to a tourniquet wherever possible, and that, when indicated, definitive ablative operations should be carried out without releasing the tourniquet. This advice is not new, and is no doubt the practice followed at many centres besides the Mayo Clinic. However, the necessity for it is brought home by this experiment in which advantage was taken of a somewhat rare opportunity.

[1] *Proc. Mayo Clin.*, 1960, 35: 443 (July 20).

THE VARIOUS GUISES OF INTERSTITIAL NEURITIS.

THE late Robert Wartenberg's posthumous monograph[1] has been called "not only the final act of a distinguished neurologist, it is also among the last studies in classical neurology".[2] In the introduction Wartenberg states that the textbook pictures of fully developed polyneuritis are seen much less frequently than lesions of one or two nerves, or even partial lesions of a single nerve. "Sensory neuritis", he writes, "has a greater place in everyday clinical practice than has thus far been allocated to it in the literature and the textbooks." He chose the subject of mononeuritis for comprehensive presentation because, through bitter experience as a consultant, he had learned how little his colleagues knew about the subject. Grievous mistakes had been made and many unnecessary diagnostic procedures had been undertaken in the search for mechanical causes of a non-mechanical disorder. However, Wartenberg did not rule out local causes. He accepted the view that the causation of all disease is multiple; neuritis often follows variable precipitating factors and chooses certain situations because of favourable local conditions. Bell's palsy is motor mononeuritis; this is less common than the sensory form, but it occurs in other situations. The occasional onset of paresis in the shoulder girdle of a soldier after carrying a pack signifies that the previously weakened musculature was unable to bear the weight. According to Wartenberg, isolated trigeminal neuritis is uncommon but does not differ from the other examples of mononeuritis. J. D. Spillane and C. E. C. Wells[3] have since reported 16 more cases in which the patients were subjected to many of

[1] "Neuritis; Sensory Neuritis; Neuralgia", 1958, Oxford University Press, New York.

[2] *J. Neurol. Neurosurg. Psychiat.*, 1959, 22: 89 (February).

[3] *Brain*, 1959, 82: 391 (September).

the complicated investigations Wartenberg would have discouraged. One trigeminal root had been decompressed; other authors had explored the trigeminal nerve to exclude tumours. Papers still continue to appear describing various aspects of interstitial neuritis as though they are rarities. R. A. Taylor[4] has described five generations involving 119 patients with "heredofamilial mononeuritis multiplex with brachial predilection". S. S. Jolly and A. Singh[5] have reported 20 cases of "neuralgic amyotrophy of the lower limbs", in which all biochemical and radiological investigations had revealed no abnormalities. D. W. Mulder, J. R. Calverley and R. H. Miller[6] in a very recent article have moved a long way in the direction of Wartenberg. They state that "autogenous mononeuropathy" is virtually the same disease whatever nerve is attacked; it often appears in healthy patients but may complicate systemic disease. The correct diagnosis, they say, depends on awareness of the disorder, and prevents the direction of extensive and expensive treatment to the wrong area.

ALLERGIC REACTIONS TO ANTITETANUS SERUM.

IN a recent paper, J. H. Toogood[1] of London, Ontario, has set out to answer the question whether reactions to prophylactic injections of antitetanus serum (A.T.S.) cause more morbidity and mortality in Canada than the disease which the serum is intended to prevent. Exact figures were difficult to obtain, but by a series of extrapolations he has estimated that about 7900 severe allergic reactions to antitetanus serum occur annually in Canada. The number of deaths from this cause is not known, but reasons are given for assuming that a few such deaths do occur each year. Toogood cites one case of fatal anaphylactic shock caused by a skin-test dose of A.T.S., and another of fatal acute hæmorrhagic leucoencephalitis due to an A.T.S. injection. Against this may be set an average of about 13 deaths from tetanus each year. Estimation of the number of cases of tetanus which occur each year depends on an assumed mortality rate, but the actual number is probably about 50 cases per year. Toogood concludes that the problem of disease due to A.T.S. allergy in Canada appears to approximate and in some respects to surpass that due to tetanus itself. He suggests that three things are essential to reduce the magnitude of the clinical problem, namely, (i) that less A.T.S. should be given; (ii) that as many individuals as possible should be immunized against tetanus; (iii) that a permanent record of this immunization should be kept, preferably in a central registry. It is clear from Toogood's figures that tetanus is less of a hazard in Canada than it is in Australia. Australia, with a population of just 10 million, has at least three times as many deaths from tetanus *per annum* as Canada, with a population of over 15 million. However, this does not invalidate Toogood's argument that avoidance of the necessity of giving injections of anti-tetanus serum is a powerful additional reason for encouraging active immunization against tetanus as widely as possible. Toogood's estimate based on figures from the Canadian Workmen's Compensation Board, that at least 20 times as many days were lost in 1955 by insured personnel from A.T.S. reactions as from clinical tetanus, is an indication of the economic aspect.

THE DISCOVERY OF REFLEXES.

PROFESSOR E. G. T. LIDDELL states in his preface to a recent book[1]: "This little book is intended to be a tribute to the life and work of Charles Sherrington. It is not a textbook and it is not a biography . . . ." As we have read the book, it has appeared to us to have more the dramatic quality of an epic. It is with consummate skill that Liddell has set out to trace the development of scientific thought in the attempt to understand the essential features of the structure and function of the nervous system. Through the eighteenth and nineteenth centuries, this was a long and often a frustrating enterprise, because physics and chemistry were not then sufficiently developed. Nor was microscopic technique adequate until the latter decades of the nineteenth century, when suddenly there was the wonderful flowering of classical neurohistology. This was the era when the young Sherrington was attracted to study the nervous system, and we can see in the book how quick he was to grasp the significance of the organization that was being revealed in the central nervous system by Cajal, von Kolliker, van Gehuchten, Golgi and others. The story that Liddell has told shows how the young Sherrington applied all this new knowledge with unerring intuition, so that he was able to build up, in a few years, the basic concepts of reflex function that have formed the foundation of the neurology that we know today.

After the three chapters that form the background upon which the performance of Sherrington is to be staged, Liddell introduces Sherrington in this remarkable way:

> In the year 1879 two events took place which, though quite unrelated at the time, may both seem now, seventy years after, to have been significant for the science of neurology.
>
> The first was the appearance of volume I of *Brain, a Journal of Neurology*. It contained, as it happened, a paper by George Henry Lewes on "Muscle Sense", an old problem which in due course engaged the attention of Sherrington and others after him. The second event was the admission of Charles Scott Sherrington to Cambridge, at the age of twenty-one.

The chapter so introduced was to us of particular interest, because Liddell himself naturally adopts a personal relationship to his subject; much that he writes about Sherrington comes from that understanding which derives from the close personal relationship that existed between Liddell and Sherrington during the Oxford phase of Sherrington's life. We are indeed grateful to Liddell for having written with such insight and appreciation of the atmosphere in which Sherrington found himself in the latter nineteenth century, and of his amazing creative achievements at that same time. Liddell has made this formative period of modern neurology live for us in a way that no one else could, and we must be very grateful.

MEDICAL BOOKS AND JOURNALS WANTED.

THE Dean of the new Medical School of Monash University, Melbourne, is appealing for suitable books and journals to help in the formation of a medical library. It is thought that, in particular, acceptable books and journals may be available from the estates of deceased doctors, and that doctors on retirement may wish to lighten their bookshelves by disposing of medical publications no longer required. In addition, individual doctors still actively in practice may care to make a gesture of goodwill to the new school along these lines.

It will be appreciated that all books and journals are not necessarily suitable. Some books retain their value over the years, others are useful only in the most recent editions. Journals are in the main of use only if they are in an uninterrupted series. It is suggested that anyone who has it in mind to give books or journals should send a list to the Librarian, Monash University, Box 92, Clayton, Victoria. The Librarian can then advise the prospective donor of what would be welcome and arrange for their forwarding at no cost to the donor. The suggestion is commended to all who are able to help.

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[4] *Brain*, 1960, 83: 113 (March).
[5] *A.M.A. Arch. Neurol.*, 1960, 2: 683 (June).
[6] *Med. Clin. N. Amer.*, 1960, 44: 989 (July).
[1] *Canad. med. Ass. J.*, 1960, 82: 997 (April 30).

[1] "The Discovery of Reflexes", by E. G. T. Liddell, D.M., F.R.S.; 1960. Oxford: The Clarendon Press. 9¼" × 6", pp. 184. Price: 54s. 6d.

Abstracts from Medical Literature.

NEUROLOGY.

Ulnar Nerve Lesions in the Hand.

P. EBELING, R. W. GILLIATT AND P. K. THOMAS (*J. Neurol. Neurosurg. Psychiat.*, February, 1960) have carried out a clinical and electrical study of ulnar nerve lesions in the hand in nine cases. Compression of the ulnar nerve at the wrist or in the palm gives rise to a distinctive clinical syndrome of weakness of the small muscles of the hand, with or without associated sensory loss. Frequently there is a history of trauma. When the nerve is injured after curving round the pisiform bone, when it has already given off its sensory branch to the ulnar two fingers and usually its supply to the hypothenar muscles, the result is a purely motor loss affecting the interossei, the medial two lumbricales, and the adductor pollicis muscle. If the lesion is a little more proximal, the hypothenar muscles are also affected without sensory loss. The authors have shown that the measurement of nerve conduction can be a useful aid in diagnosis. Not only can it suggest a local nerve lesion, but it can sometimes indicate its site with some accuracy, and also help in assessing the beginning of recovery before clinical evidence is available. The cause of the lesion is usually traumatic.

Myoclonus.

B. R. AIGNER AND D. W. MULDER (*A.M.A. Arch. Neurol.*, June, 1960) have studied the records of 94 patients with myoclonus seen at the Mayo Clinic. These include a follow-up at intervals of 2 to 15 years after the initial examination. As a result of this study the authors divide patients with myoclonus into four classes. These are as follows: Group I, patients with myoclonus, epilepsy and neurological abnormalities or mental retardation, or both; there were 26 in this group. Group II, patients with myoclonus and epilepsy, but no neurological lesion; there were 45 in this group. Group III, patients with myoclonus only; there were 19 in this group. Group IV, patients with myoclonus and neurological or mental deficits, but no epilepsy; there were four in this group. The authors conclude that in this series of patients myoclonus was a symptom of a wide range of diseases of the central nervous system. The prognosis for the individual patient therefore depended not on the myoclonus but on the presence or absence of other neurological diseases. The authors discuss the relationship between epilepsy and myoclonus and conclude that the incidence of myoclonus in epileptic patients, while somewhat greater than that in the normal population, is not a characteristic feature of epilepsy and probably reflects a generalized cerebral disturbance of which seizures are but a manifestation.

Recurrent Cerebrovascular Episodes.

D. DENNY-BROWN (*A.M.A. Arch. Neurol.*, February, 1960) discusses recurrent cerebrovascular episodes and draws attention to the need to define the mechanism of the attack in any particular case of ischæmia before more rational treatment can be devised. He points out that cerebrovascular insufficiency results from stenosis or occlusion of one or more of the larger cerebral arteries and is manifested by recurrent episodes in the territory supplied by the affected vessel. The causes of the critical episodes are multiple, but include lowered systolic blood pressure, anæmia and increased blood viscosity. The resolution of such insufficiency is obtained by compensatory collateral circulation, for which adequate systolic blood pressure and oxygenation of arterial blood are of most importance. Failure of compensation may be due to stenosis of multiple vessels, hypertension, anomalous vascular distribution or damage to the vertebral arteries in the neck. Repeated embolism may be responsible for frequent small attacks, and this group have the most striking response to anticoagulants. Anticoagulants, however, are not indicated when infarction has already occurred. In a small group compression of the carotid artery by the first transverse process, or of the vertebral arteries by an anomaly of the first and second cervical articulations, can be demonstrated. Restriction of neck movement may help these cases.

Encephalitis in the Pathogenesis of Epilepsy.

M. J. AGUILAR AND T. RASMUSSEN (*A.M.A. Arch. Neurol.*, June, 1960) have analysed the clinical records of 32 cases in which histological examination of specimens, removed at the Montreal Neurological Institute in the course of treatment for focal epileptic seizures, had revealed evidence suggesting active encephalitis. They conclude that focal cerebral seizures in children and young adults who show clinical electroencephalographic and radiological evidence of progression of signs and symptoms, and whose psychological test data indicate marked deterioration, may be symptomatic of chronic encephalitis. The pathological changes in such cases include widespread perivascular cuffing, microglial activity, chronic leptomeningeal inflammation, gliosis, and rarely intranuclear inclusion bodies in neuroglial cells. A history of febrile illness in childhood with convulsions, later epilepsy and progressive neurological signs, such as hemiparesis and intellectual deterioration, may indicate the presence of chronic focal encephalitic infection. Some of the authors' cases indicate that surgical treatment may be successful when the disease process is relatively quiescent and the epileptogenic area localized.

Results of Chemopallidectomy and Chemothalamectomy.

TUNG HUI LIN AND I. S. COOPER (*A.M.A. Arch. Neurol.*, February, 1960) present the results of chemopallidectomy and chemothalamectomy in 100 patients with Parkinsonism over 60 years of age. They state that 75% of patients operated on had complete or virtually complete relief of contralateral tremor and rigidity as well as bradykinæsia and attendant locomotor difficulties. One-third of the group had difficulty in gross volitional movements, i.e., turning in bed, getting out of a chair and walking. Half of the group prior to operation could do their full-time occupation or housework and were essentially independent in carrying out their daily activities. The main postoperative complications were mental confusion and speech disturbance. The mortality rate in the group was 3%.

All Epilepsy is One.

R. P. MACKAY (*A.M.A. Arch. Neurol.*, March, 1960) undertakes a clinical and neurophysiological analysis of the convulsive state and concludes that all epilepsy is one disorder evoked by any of a number of clinical and pathological conditions and dependent on characteristic disturbances in neuronal networks. The discharge begins focally as a result of a local pathological process and consists of the assumption of autorhythmicity and hypersynchrony of discharge in local neuronal populations. It spreads by synaptic or non-synaptic paths to neighbouring neurons and induces in them the same autorhythmicity and hypersynchrony. The discharge may end at any point and so remain focal, producing a subclinical seizure. The discharge may continue to spread until it involves wide cerebral areas and produces a major convulsion. *Grand mal* is thus not a kind of epilepsy but only a degree of epilepsy.

PATHOLOGY.

Incidence of Breast Cancer.

M. T. MACKLIN (*J. Nat. Cancer Inst.*, November, 1959) has surveyed 295 patients with cancer of the breast in Ohio, and has come to the conclusion that nulliparæ, irrespective of marital status, are more susceptible to cancer of the breast than multiparæ. She found also that nulliparous women closely related to a woman with breast cancer have more breast cancer than nulliparous women in the general population. This article also discusses socio-economic factors in breast cancer.

The Blood Groups of Gastric Ulcer Cancer.

W. H. BEASLEY (*J. clin. Path.*, July, 1960) has analysed a group of 708 cases of cancer of the stomach. He found that there were 59 (8·3%) examples of ulcer cancer. The blood groups of 57 of these were known and there were 29 (50·9%) cases of blood group A against 21 (36·8%) of group O. Amongst 518 primary cancers there were 236 (45·56%) of blood group A against 228 (44·01%) of group O. The author considers that the preponderance of group A persons with ulcer cancer is statistically significant.

Cardiomyopathy.

J. HIGGINSON *et alii* (*Arch. Path. (Chicago)*, October, 1960) have studied a form of cardiomyopathy occurring in the Bantu, which they designate cryptogenic heart disease. This disorder is the commonest cause of admission to hospital for cardiac failure and it was encountered in 80 out of 537 cardiac deaths. The heart failure caused by this disorder is of the hypodynamic type and the patients present in recurrent attacks.

At necropsy the heart is always large, dilated and hypertrophied, with mural thrombi in 48 of the 80 cases. Organization of these thrombi leads to the formation of thick fibrous endocardial plaques. The authors suggest that stasis plays a part in the intracardiac thrombosis, though they cannot deny that an endocardial lesion may be the basic lesion. The ætiology of the disease is obscure. The position of alcoholism as a cause is difficult to assess because there was no case showing a fatty liver, although alcoholic beverages are widely used amongst the Bantu.

Carcinogenic Studies on Soot of Coffee-Roasting Plants.

W. C. HUEPER AND W. W. PAYNE (*Arch. Path.* (*Chicago*), June, 1960), in their search for an explanation of the unusually high morbidity and mortality from cancers of the lung, larynx and bladder amongst the resident population of New Orleans, discovered that there was a significant contribution to air pollution by the effluent from coffee-roasting plants. The discovery of 3,4-benzpyrene in the soots has already been announced; the authors' present contribution deals with the bioassay of these soots for carcinogenic properties for mice, rats and guinea-pigs when administered by cutaneous application, by intramuscular injection and by inhalation. The authors obtained precancerous lesions, and benign and malignant neoplasms of skin, connective tissue, stomach and bladder. However, they do not consider that the effluents from coffee-roasting plants are a major causal factor in the high incidence of cancer of the lung, larynx and bladder in New Orleans, but they do believe them to be contributory.

Benign Hodgkin's Disease.

C. J. E. WRIGHT (*J. Path. Bact.*, July, 1960) reports 24 new examples of Hodgkin's paragranuloma, half of which have been followed up for 10 to 35 years, and all but one for 5 years or more. He found that recurrence was quite frequent, but usually local. Generalization of the disease may occur as a late manifestation following a long period (5 to 15 years) of freedom from symptoms and clinical signs. That such spread is not inevitable is instanced by examples in this series of survival in good health up to 35 or more years. The diagnosis usually made is lymphosarcoma or Hodgkin's disease, but the prognosis is better than in either of these two disorders. The author regards this disease as a variant of Hodgkin's disease. He thinks an accurate diagnosis is possible and he stresses the importance of this. In general, Hodgkin's paragranuloma, or "benign" Hodgkin's disease, is fairly rare, comprising only one-thirteenth of the 339 cases of Hodgkin's disease in the series reviewed by the author.

The Incidence of Myocardial Infarction in Women.

F. GOODALE *et alii* (*Amer. Arch. Path.*, June, 1960) have studied data on the incidence of myocardial infarction in autopsy subjects at three large medical centres, namely, the Massachusetts General Hospital in Boston, the Radcliffe Infirmary in Oxford, and Washington University Hospital in St. Louis. They found that the autopsy incidence of acute myocardial infarction in subjects over 50 years of age was statistically similar for men and women in all three centres. These data agreed with those derived from clinical diagnoses of patients dying at the Barnes Hospital in St. Louis. However, among those patients discharged alive, acute myocardial infarction was diagnosed clinically in men much more frequently than in women. The authors suggest that there may have been a lack of clinical suspicion of the disease in women which would affect the accuracy of clinical diagnoses in mild cases. Although the accuracy of diagnoses made at autopsy is much greater than in those made clinically, it must be borne in mind that there is a certain amount of selection in autopsy cases.

The Incidence of Carcinoma of the Liver.

E. A. GALL (*Arch. Path.* (*Chicago*), August, 1960) has studied the incidence of hepatic carcinoma encountered at autopsy at the Cincinnati General Hospital during the period 1921 to 1958. He found 96 examples of primary carcinoma of the liver. Amongst 682 cirrhotic patients there were 58 carcinomas. Hepatocellular carcinoma was found to have a particular predilection for post-hepatic and post-necrotic cirrhosis (13% and 20%) but was exceedingly uncommon in cases of alcoholic cirrhosis. Cirrhosis did not appear to precede cholangioma as a rule, but tended rather to follow its development. Metastatic carcinoma was not a common complication of cirrhosis, and its incidence (4·2%) was lower than in the general population without cirrhosis (10%). In general, metastatic carcinoma was rare in all forms of cirrhosis except in biliary cirrhosis, in which it was observed in about one-third of the cases.

The Relative Values of Serological Tests for Syphilis.

T. B. MAGATH (*Amer. J. clin. Path.*, October, 1960) discusses the various serological tests for syphilis in the light of the data obtained by the Serological Evaluation and Research Assembly, 1956-1957, of the Venereal Disease Branch, Communicable Disease Centre of the United States Public Health Service. The main finding was that tests ranking high in specificity were low in sensitivity, and vice versa. Data are presented on which the relative value of the various tests for syphilis may be assessed.

Nasal Granuloma.

E. W. WALTON (*J. clin. Path.*, July, 1960) has added to the literature five cases of a granulomatous condition of the nose which has a neoplastic basis. This condition differs from the classical malignant granuloma and from Wegener's granulomatosis in its neoplastic characteristics. Granuloma gangrenescens, as it is termed, has a fairly constant clinical pattern. The initial lesion is an ulcer of the nose or palate in which the original biopsies nearly always showed non-non-specific granulomatous inflammation which regressed with irradiation. The local lesion in each case produced erosion of the cartilaginous and bony framework of the nose and palate and when adequate tissue was examined this was found to be neoplastic. In some cases spread to the skin occurred and produced large fungating tumour masses. Metastases recurred in many organs, usually the lymph nodes, skin, liver, kidney, spleen and lung. On occasions the heart, gonads and thyroid were also involved. The tumour deposits were usually in the form of diffuse infiltrates, less frequently they formed discrete nodules. Histologically the tumour was composed of large tumour cells of reticuloendothelial type.

Generalized Scleroderma and Carcinoma of Lung.

J. G. BATSAKIS AND H. A. JOHNSON (*Arch. Path.* (*Chicago*), June, 1960) have added to the world literature a sixth example of pulmonary adenocarcinoma occurring in the fibrotic lungs of patients with scleroderma. Fibrosis was also present in the liver to an extent which almost reached cirrhotic proportions.

Mucoid Impaction of the Bronchi.

J. B. HUTCHESON *et alii* (*Amer. J. clin. Path.*, May, 1960) have recorded the clinical and pathological features of 27 examples of mucoid impaction of bronchi. Clinically, asthma, bronchitis, and respiratory infections were the most frequently associated features. The condition results from narrowing of the bronchial lumen, secretion of viscid mucus and dehydration of the secretions. If the patient cannot expel the plug of mucus, the impaction enlarges progressively and causes continued dilatation of the bronchus which encloses it, followed by chronic pneumonitis, bronchiectasis and abscess formation. The clinical and radiological features may simulate carcinoma or tuberculosis. Surgery is indicated for irreversible secondary suppuration, and is frequently necessary in order to establish the diagnosis.

Pathological Features of Asthma.

M. S. DUNNILL (*J. clin. Path.*, January, 1960) has studied the pathological features of 20 subjects who died in status asthmaticus. In gross sections the lungs show no emphysema, but mucus plugs in the air passages and focal areas of collapse were outstanding features. In five cases the lungs showed cystic bronchiectasis which was of a similar distribution to the focal areas of collapse, occurring in the upper lobes as commonly as in the lower lobes. Histologically, shedding of the ciliated bronchial mucosal cells was prominent and this is attributed to a transudation of œdema fluid from the submucosa. Areas of regeneration of the mucosa, with the presence of simple stratified epithelium, were seen frequently. The loss of the ciliated respiratory epithelium and the transudation of œdema fluid into the bronchial lumen, with interference with the action of the remaining ciliated cells, are considered to be the essential factors in the failure of clearance of the bronchial secretions in asthma. It is postulated that bronchospasm plays little or no part in the shedding of the bronchial mucosa or in the pathogenesis of the asthmatic attack.

Brush Up Your Medicine.

CAUSES AND TREATMENT OF INSOMNIA.

SLEEP is to be regarded as "a periodical physiological depression of function of those parts of the brain concerned with consciousness induced by the appropriate state of the reticulo-hypothalamic system" (Russell Brain). Insomnia is the inability to sleep when sleep is required or desired, or to obtain the normal amount of sleep. It is not a disease *per se*, but a symptom indicating a physical or mental disturbance, or faulty habits and hygiene. It is one of the commonest symptoms encountered in medicine. It is not so much the lack of sleep that is so disturbing to patients with insomnia, as the hours of restless wakefulness with aimless, crowding thoughts, often unpleasant, and the seeming endlessness of time.

TYPES OF INSOMNIA.

Insomnia occurs in the following different patterns: (i) difficulty in getting off to sleep, as seen in patients affected by anxiety, physical discomfort, etc.; (ii) restless, fitful sleep, which is light, and from which the patient is easily disturbed; (iii) early morning waking, as seen in depressive states; (iv) inversion of sleep rhythm, which may be due to conditioning factors in shift workers, or which may be seen in cases of encephalitis or toxic confusional states and delirium; (v) absolute insomnia, as seen in certain psychoses such as mania, or from overdosage with amphetamine.

CAUSES OF INSOMNIA.

Physical Causes.

Physical causes may be either external of internal; external causes are as follows: (i) bad atmosphere in the home before retiring; (ii) sudden change in routine or place (such as admission to hospital); (iii) noise, heat, stuffy atmosphere, cold, too many or too few bedclothes, too much light, uncomfortable pillow or bed, fleas, mosquitoes; (iv) someone snoring in the same room; (v) conditioning by shift work, caring for an invalid; (vi) too much sleep through the day or insufficient fatigue. The last-mentioned factor is seen in bed patients in hospital, and also in old people who have daytime naps and potter about the house all night.

Internal physical causes are as follows: over-eating, hunger, thirst, full bladder, pain, fever, cough, breathlessness, blocked nose, itching (especially from threadworms), dermatitis, scabies, toxic states (commonly causing a reversal of sleep rhythm), undue fatigue, bodily or mental, the momentum of monotonous, repetitive stimuli (for example, the driver who keeps on driving).

Psychological Causes.

Psychological causes may be conscious or unconscious. Powerful emotions of any kind militate against normal sleep.

Conscious Causes.

The following are conscious causes: (i) excitement—anticipatory of or following a game, an argument, a play, a film or a political meeting; (ii) anger—especially if it is partially or wholly unexpressed and bottled up (for example a wife lying beside a husband with whom she feels angry); (iii) anxiety over sickness, business, examinations; (iv) guilt or shame, regret or remorse, when aggression is self-directed and there is brooding on the "what might have been"; (v) fear—of illness, of pregnancy or of financial ruin; (vi) love—especially unrequited love, unsatisfied desire or sexual arousal without release.

Unconscious Causes.

Neurotic Insomnia.—In neurotic insomnia, unconscious tensions are involved. It is in this group that most of the chronic types of insomnia are found, usually accompanied by a variety of other neurotic symptoms. Once insomnia has been started, perhaps through any of the causes mentioned earlier, it may be kept going in predisposed anxious patients by a self-perpetuating cycle of factors. For instance, the patient may try to compensate for insomnia by spending more than eight hours in bed, as a result of which he has insufficient muscular fatigue. The fear of insomnia and its imagined consequences make it too important to the patient. He becomes tremendously interested in whether he will sleep or not, and, as with other neurotic symptoms, makes a fetish of the insomnia and surrounds it with all kinds of exaggerated views. At night, in the drowsiness which is a prelude to sleep, imagination and fantasy formation may take over. The ego seems eager to let go of reality, and instinctive drives unsatisfied and repressed through the day try to pass by the relaxed conscience. This is seen in dreams; but if the anxiety associated with these drives is too great, dreams fail and sleep is shattered. Sexual and aggressive impulses, being those most often subject to repression, are commonly involved. These unwelcome thoughts and impulses, successfully repressed by day when interest is diverted by activity, break through at night on retiring. The patient may then experience acute panic, which in turn is often accompanied by overbreathing or hyperventilation. This results in symptoms of mild tetany due to alkalosis, which is usually interpreted by the patient as evidence of heart disease, impending death or insanity. Neurotic insomnia is most often a difficulty in getting off to sleep or a restless, unsatisfying sleep disturbed by frightening dreams. In most cases it is not the want of sleep that makes patients feel bad the next day, but the anxieties over which they have been brooding. Patients may honestly deny the existence of any fears, anxieties or conflicts, because they are unconscious. On the other hand, a tension may exist of which the patient is fully conscious, but without being aware of the connexion with his symptoms. Common in this type of insomnia is the conflict between strong dependency needs and inferiority feelings on the one hand, and a high level of aspiration on the other. This ambitiousness, which is neurotically determined and based on an attempt to compensate for the inferiority feelings, results in the patients' biting off more than their limited emotional capacity can digest. Such people are commonly over-conscientious, rigid, obsessional, meticulous individuals, because their ego cannot afford to stand criticism resulting from error. Rather than a fear of insomnia, some neurotic patients may have a fear of sleep. This may be due to the fear of dreams in which disturbing thoughts occur which the patient is trying not to think of through the day. Most patients will not admit this fear, as they think they will be regarded as mad. Sleep and death are often associated in patients' minds, fear of sleep often symbolizing fear of death. This is more often the case in the next group.

Psychotic Insomnia.—In this variety of insomnia, it is as though the ego perceives itself as so weak or so near shattering that it can be no match for the terrors that lurk in the unconscious. A real sleep phobia exists, producing the most severe kinds of insomnia. Sleep is not even courted, but is fearfully shunned and avoided as long as possible.

Insomnia is a common symptom in early schizophrenia, in mania, in psychotic depression and in acute toxic-confusional states.

TREATMENT.

It is important to determine whether true insomnia really exists, or whether one is merely listening to a complaint that is not founded. Most patients habitually underestimate the amount of sleep they get.

A sympathetic interrogation into the patient's history, habits, personality, problems and anxieties, by providing an opportunity of ventilation, is often therapeutic in itself. A mere search for remedies is futile when the basic cause is unknown and untreated. Therefore the first step must be the taking of an adequate history, in which the complaint is viewed against the background of the patient's personality and life situation.

The next step is to teach the patient to put the symptom into its proper perspective, and to know that the fear of sleeplessness is one of the major causes of sleeplessness. In some cases insomnia is lessened when the patient sees that he sleeps better when he retires with the attitude of not caring whether he sleeps or not. We sometimes have to train people into the right mood for sleep. As soon as they realize that insomnia is not as serious as they think, they still may not sleep, but at least they feel better next day. The patient's cooperation should be secured in ensuring that he spend no more than eight hours in bed whether he sleeps or not. Hospital patients, of course, are resting anyway, and cannot be expected to sleep all night if they sleep a lot through the day.

Each man must find for himself the best balance in the constant fight between the instincts and the conscience, and there is an old saying that "the best pillow is a good conscience and the best bed a day of satisfaction".

Physical Causes.

Treatment of external physical causes is obvious—by simply removing the cause, improving the comfort, avoiding tea and coffee before retiring, etc.

Treatment of internal physical causes is also obvious—by providing treatment for the cause, with sepcial attention to pain, cough and itching.

Psychological Causes.

Conscious Causes.

The main treatment of insomnia with a conscious psychological basis (or what one may term rational anxiety) is to encourage free and open discussion, giving reassurance, encouragement and perhaps some good practical advice. Ventilation, "getting things off one's chest", sharing the burden with a trusted confident and receiving unbiased and non-judgemental support, is frequently sufficient emotional purgation to ensure a sound sleep. In this group, in which insomnia is only a temporary condition, it may be foolish not to use a hypnotic drug temporarily, as habituation is not a big risk.

Unconscious Causes.

Neurotic Insomnia.—In this condition, improvement with hypnotics is partial and short-lived if no constructive psychotherapy is used involving recognition, understanding and resolution of inner conflicts. If these patients are given drugs to make them sleep, they will make no effort to understand why they do not sleep. Of course, drugs are permissible until the cause of their anxiety is elicited; but if it is continued indefinitely, sedation merely encourages passive dependency and possible habituation, whilst leading away from the direct search for a workable solution. By encouraging open discussion we must try to make the patient aware of his problem, which may be unconscious, and which he may insist does not exist. Explore the day-time thoughts that are carried on into bedtime hours and try to deal with any phobia about sleep. The disturbing dreams may give a clue to the hidden anxiety. Rarely does insomnia occur as a single isolated symptom in a neurosis; but many neurotic patients will state that all other symptoms are secondary to insomnia. However, it is well known that such patients, when recovering, may lose all other symptoms before they lose their insomnia. When a patient is plagued by the secondary fears following the effects of hyperventilation, it is reassuring to give him a hyperventilation test in the surgery reproducing the symptoms of mild tetany, and giving a simple explanation of the mechanisms involved. It is never sufficient to say "it's all due to nerves" unless an explanation is given to account for the symptoms, which are very real, and which may be erroneously interpreted by the patient as being due to heart disease, etc. A large proportion of neurotic patients have amongst their phobias one of addiction to drugs and, unlike some of their fellow sufferers, will take less instead of more than the prescribed dose. "Hangover" from relatively small hypnotic doses occurs, especially amongst neurotics, as they seem to feel that they owe it to themselves always to complain of "waking up drugged" whenever they believe they have been given a hypnotic. The effective amount of sedation required by emotionally disturbed pople is greater than that required by those not so disturbed. However, the casual prescription is never an ultimate solution, though it is an easier and therefore often a more attractive course than discussing the patient's problems. It is wise never to leave sedation to the discretion of the nurses. Treatment sheets should be reviewed at least twice a week. Nurses' enthusiasm with sedatives is rapidly replacing the older generation's enthusiasm for aperients. Sedatives left by the patient's bedside should always be left in solution, to prevent storage or taking an overdose. Some drugs more than others are dangerous because of their tendency to induce a habit and to necessitate an ever-increasing dose. This tendency is usually laid solely to the discredit of the drug itself, whereas the other factor in the situation, the individual, is often forgotten. One must always be on the lookout for the psychopath or hysterical patient who lacks all restraint. One group never to be fully trusted is that of female patients, usually between 48 and 60 years of age with marked hypochondriasis. The emotionally immature hysteric is another menace. These individuals are theatrical, histrionic and demanding on those in their immediate environment. They take overdoses of drugs in attempts to manipulate things to their own ends. Drugs for old people, who are apt to become confused easily, should be well tolerated, of low toxicity and non-cumulative. Bromides and long-acting barbiturates are best avoided.

Bromides are poor hypnotics. They act by replacing chlorides and readily accumulate, causing sluggishness and retardation. A single dose may remain in the blood for over a month if no salt is taken. If they are prescribed, they should be given only for short periods, and an adequate fluid and salt intake should be ensured, as well as satisfactory renal efficiency. Toxic symptoms of fatigue, sluggishness, confusion, depression, ataxia and stupor occur at various blood levels from 100 mg. per 100 ml. in old people to 350 mg. per 100 ml. in the young.

Paraldehyde is safe, acts in 15 minutes and can be given by mouth, by the rectum or by intramuscular injection. It is useful in delirious states. In spite of the unpleasant taste and smell, addiction is known. It decomposes in sunlight.

Chloral hydrate must be prescribed in solution. It does not accumulate, but may be irritating to an empty stomach and should be taken well diluted. It is inexpensive, and when suitably flavoured is useful for infants. It is incompatible with alcohol, ammonia compounds and alkalis.

The most important side effect of the antihistamine drugs is a sedative one. This may be advantageous, as many allergic patients are also neurotic. Those that appear to have the most strongly sedative effects are "Perazil", "Phenergan", "Benadryl" and "Allercur". The effects occur somewhat later than those of barbiturates. It is advisable to warn patients taking these drugs not to drive their cars.

"Oblivon" (methylpentynol) is non-toxic, and acts by filtering off the tension-inducing impulses crowding the patient's mind. It may be useful in the case of acute and conscious anxiety reaction.

Phenylethylglutarimide ("Doriden") acts moderately quickly, has no hangover and seems suitable for the aged. It is presented in tablets of 250 mg equivalent to 1·5 grains of pentobarbital. "Noludar" is somewhat similar. The barbiturates are of three types—short-acting, intermediate and long-acting. The short-acing barbiturates are cyclobarbitone (four to six hours), and quinalbarbitone ("Seconal") (four to six hours). The intermediate barbiturates are pentobarbital (six to eight hours) and amylobarbitone (six to eight hours). The long-acting barbiturates are "Medinal" (eight to 16 hours), phenobarbital (12 to 24 hours) and butobarbitone (eight to 10 hours). Habituation and addiction to barbiturates are extremely common, particularly amongst psychoneurotics and those with personality and character disorders. The psychoneurotic addict is more common that the latter type, and this type of addiction is usually the result of doctor-prescribed medication.

Insomnia in Childhood.

In early infancy, insomnia is mostly due to bodily discomfort or physical illness; but anxiety in the mother can be readily transferred to the infant in subtle ways. Children who jerk, head-roll, jump, talk or cry in their sleep are usually children who are restless, over-active and easily excited. It is important to attack the factors responsible for their increased mobility by looking for environmental stress and strain and trying to improve the home atmosphere.

True insomnia is rare in children unless it results from pain and itching, etc. In most cases it is an unwillingness rather than an inability to sleep. This may be part of a general negativism or it may be a means of gaining attention. This pattern can start quite early and then develop into a much more complicated ritual. It includes (i) refusal to go to bed, with arguments, excuses and delays; (ii) rituals, crying, calling, playing in bed; (iii) waking at night, calling for the parents until calmed or taken into the parents' bed. Such children often show other signs of defective training—for example, in feeding and excretion—and their parents are often irregular and erratic people who set a bad example.

Treatment.

Adenoids and the ubiquitous threadworm need their own specific remedies.

Prophylactic measures are better than drugs, which are generally quite out of place in treating chronic insomnia in children. Children should not be punished by being sent to bed, as bed and the associated sleep become things to resent, and perhaps associate with fear. The same applies to dark rooms. Sources of excitement should be removed one hour before bedtime. Children should not be sent straight to bed after an exciting game or party, or if they have had a long nap during the day. Encourage

regularity without obsessiveness, and do not over-emphasize quietness. Some parents talk in front of children of the exciting things that happen at night, making children interested to stay awake so as not to miss them.

IAN SIMPSON, D.P.M.,
Sydney.

Out of the Past.

ADMISSION OF PATIENTS TO THE SYDNEY HOSPITAL.[1]

[From the *Australasian Medical Gazette*, March, 1902.]

THE following extract from the annual report of the Directors of the Sydney Hospital deals with the abolition of payment by patients:

"One of the most important steps taken for many years was decided upon last November in regard to 'paying patients'. It has been apparent that the system of receiving payment from patients in partial satisfaction of the cost of their maintenance has given rise to many misunderstandings with both the public and the patients; also, unscrupulous persons have frequently endeavoured, under the cloak of assumed poverty, to obtain all the benefits of the hospital at a cost of a few shillings per week. It appeared to the Board, too, that the practice of sending the destitute sick and feeble to the Government for a pauper order of admission was subjecting them to an unnecessary delay and humiliation. Accordingly, the Board decided upon the drastic step of abolishing the system of taking 'paying patients', and to admit all deserving cases, so far as the accommodation of the hospital will admit, without stipulation for payment, and without referring them to the Government for the pauper order, stringent precautions being taken to prevent abuse of the charity. In order to do this, an arrangement has been verbally made with the Government satisfactory to both sides, under which the hospital receives from the Government the same amount as has hitherto been paid for the maintenance of Government patients."

Clinico-Pathological Conferences.

A CONFERENCE AT SYDNEY HOSPITAL.

A CLINICO-PATHOLOGICAL CONFERENCE was held at Sydney Hospital on April 19, 1960. DR. W. L. CALOV was in the chair. DR. P. FRANCIS was the principal speaker.

Clinical History.

A male metal machinist, aged 59 years, became increasingly dyspnœic on exertion and suffered palpitations about July, 1957. In October, night sweats and headaches began and continued. In March, 1958, he developed an acute sore throat, the sweats became drenching, and occurred three or four times a night, being sometimes associated with rigors. This condition was diagnosed as acute follicular tonsillitis, and treated with tablets and gargles. A week later the throat condition had improved, but a pustular eruption appeared on his lips, and several small spontaneous bruises developed on his legs, then on his arms, chest and neck. While sitting on a commode a few days later, he experienced a sudden severe pain down the back of his left leg, and the pain persisted. After another few days he had several small hæmoptyses and a severe epistaxis, and then noticed hæmaturia. He was admitted to hospital. He had had typhoid and rheumatic fever in his early twenties, and had undergone appendicectomy at the age of 50 years. He was a light smoker and drinker.

On examination, the patient was a pale man in no distress, with a blood pressure of 180/100 mm. of mercury and a pulse rate of 80 per minute. A systolic murmur was heard over all areas, but maximal at the apex. The heart was not enlarged. There were several recent purpuric spots on the forearms, face and legs, and a few ecchymoses. There was generalized moderate lymph-gland enlargement. The glands were firm and not tender. The liver was palpated 4 cm. below the costal margin; it was smooth, firm and tender. The spleen was just palpable. Severe sciatic pain occurred on raising of the left leg. There was gross hæmaturia.

Hæmaturia continued, and there was an intermittent pyrexia with a temperature up to 100° F. at night. The sciatic pain became worse. Three days after his admission to hospital he suddenly became deeply unconscious, and sweated; his blood pressure was 220/120 mm. of mercury, his neck was stiff, his reflexes were brisk and his pupils were small and equal. He rapidly became areflexic. The blood pressure fell to 165/65 mm. of mercury, the pulse rate rose to 150 per minute, the number of respirations fell to six per minute and his temperature became subnormal. He died two hours later.

Clinical Discussion.

DR. W. L. CALOV: I will ask Dr. Peter Francis to discuss the case and anticipate the answers.

DR. P. FRANCIS: Thank you, Sir. Ladies and gentlemen, the case for discussion this afternoon is that of a man, aged 59 years, who died suddenly after an illness of eight and a half months of apparently insidious onset. He had a multiplicity of symptoms, and on examination manifested obvious physical abnormalities. On the other hand, there is a complete lack of laboratory data to guide or confuse us—a situation that modern physicians try to avoid at all costs.

The man was 59 years old, a metal machinist, and he became increasingly short of breath on exertion and had palpitations eight and a half months before his admission. He remained that way for three months, when new symptoms appeared in the form of night sweats and headaches. Most of these symptoms are non-specific.

Eight months after his first symptoms he developed an acute sore throat, the sweats became much more severe and he had some rigors. His doctor diagnosed acute follicular tonsillitis, and treated him with tablets which I assume would almost certainly not be aspirin, but sulphonamides or penicillin. One wonders, at this stage, in view of the subsequent progress, whether this was one of these very rare cases of thrombocytopenia or pancytopenia following sulphonamide therapy, or whether the sore throat was the first manifestation of some depression of his neutrophil polymorphonuclear leucocytes, or possibly of his gamma globulins. At all events, the tablets seemed to do some good, for a week later his throat was better, or maybe they did some harm, since he also developed a pustular eruption on the lips and some scattered bruising.

A few days later he sat on a commode and developed acute sciatica, which persisted. This sudden onset of pain is a point of some interest, and I will return to this later.

A few days later he noticed hæmoptyses and several epistaxes, and he noticed blood in his urine. He was then admitted to hospital.

Physically he was said to be pale, and I assume that he was anæmic. He was in no distress, his blood pressure was 180/100 and he had a slight tachycardia.

One thing I would have been interested to know here is, whether he had lost any weight, because it could be important in the general story. A systolic murmur was heard in his precordium, and was described as being heard at all areas and maximal at the apex, thus conforming with the majority of systolic murmurs heard in this hospital. I do not think we can learn very much from that description. His heart was said not to be enlarged on clinical examination.

There was generalized glandular enlargement, and the glands were described as firm and non-tender. I am accepting this to mean that the glands were not enlarged in one area more than another, and I think this is of some significance. They were non-tender and firm, and I take that to mean that they were not fluctuant, nor stony hard to suggest secondaries from cancer.

His liver was a little enlarged—4 cm. below the costal margin—firm, tender and smooth. The spleen was just palpable. He had sciatic pain on hip flexion. There was gross hæmaturia.

His progress in hospital was rapid. He continued to show hæmaturia, he had pyrexia and he continued to complain of sciatica. Three days after admission he suddenly became unconscious and sweaty, with a raised blood pressure of 220/120, and he had a stiff neck. I am prepared to accept this final episode as one of cerebral hæmorrhage without further ado. In a patient who is bleeding from every other possible site, it would be unlikely that such a picture

[1] From the original in the Mitchell Library, Sydney.

would be due to other things such as a cerebral thrombosis. There is one other possibility, I suppose, that this may have been a cerebral embolus from rheumatic endocarditis; but it is not usual for patients to become suddenly unconscious without localizing neurological signs—rather, they present with localizing neurological signs, without immediately losing consciousness.

So to summarize, we have a 59-year-old man who had been unwell over a period of eight months with symptoms of palpitations, exertional dyspnœa and night sweats, then, after an acute sore throat, he developed symptoms of a more ominous nature.

If I may, in the manner of the American Heart Association, chalk up major and minor manifestations, I would put the major manifestations here as: (i) bleeding—the most major manifestation; (ii) fever—probably prolonged; (iii) enlargement of glands, liver and spleen; (iv) sciatica. There are various other manifestations, such as hypertension, cardiac murmur and sore throat, which we could call minor manifestations. I am allocating major and minor points not solely on their grossness, but also on the way they seem to fit into the picture as a whole. At this stage it is worth taking note of the insidious onset of symptoms contrasted with the abrupt termination of life.

Many of these features suggest an infectious process, and like all good textbooks of medicine, I mention these first to get them out of the way. His initial symptoms of dyspnœa, palpitations, sweating and headache bring to mind certain chronic infections, such as brucellosis, bacterial endocarditis and tuberculosis. The later features during the last two weeks are more suggestive of an acutely disseminated infection.

In view of the course of the illness and its fatal outcome, however, there are very few infections which warrant serious consideration. Brucellosis, for example, although in its chronic form it is characterized by weakness, headache, sweats and effort intolerance over long periods, could hardly be imagined to terminate in this way, and infectious mononucleosis, though it has been known to produce thrombocytopenia, rarely causes such profuse bleeding. In addition, the length of history tends to exclude mononucleosis. If we were discussing the case of the banks of the Mississippi rather than the shores of Sydney Harbour, histoplasmosis should be included. Histoplasmosis, in addition to its more usual and relatively benign pulmonary form, rarely occurs in a disseminated malignant form. In about one-third of cases there is evidence of a past or present muco-cutaneous ulcerative lesion, presumably the initial site of infection. Fever is often present, and enlargement of liver, spleen and lymph glands may occur.

Given a past history of rheumatic fever, a cardiac murmur (even if it is functional due to anæmia) and anæmia (though we have bleeding to account for the pallor), together with evidence of prolonged fever, we must consider subacute bacterial endocarditis.

Fever, anæmia and murmur are present in the majority of cases of subacute bacterial endocarditis, and the systolic murmur here could be interpreted as that of mitral incompetence or of aortic valve disease. I would point out here that functional flow murmurs such as we see in fever or anæmia, although they originate at the pulmonary or aortic orifices, may be heard almost anywhere or everywhere over the precordium and often maximal at the apex or down the left border of the sternum. In addition, a third heart sound is often heard, and this makes interpretation of these signs difficult in a febrile patient.

The length of history is by no means against subacute bacterial endocarditis, for such cases sometimes smoulder on for many months undiagnosed. However, subacute bacterial endocarditis would hardly explain the generalized glandular enlargement and the sudden sciatica, and there is no record of raised jugular venous pressure or œdema to suggest that congestive cardiac failure is the reason for the hepatic enlargement. I believe that such severe bleeding would be unusual in subacute bacterial endocarditis.

Finally, the possibility remains that bacterial endocarditis is present in addition to some primary condition, though I think this would then be more likely to be a terminal acute endocarditis. This may complicate many conditions, and I am sure many of us have had the unpleasant experience of seeing an acute bacterial endocarditis first diagnosed by the pathologist. It is a condition we must always keep in mind in patients who have prolonged or severe fever.

If we are to postulate an infective process to explain the whole cause of this malady, then the picture presented rather suggests an infection lurking in the background for perhaps eight or 12 months and suddenly becoming disseminated. In the past 10 to 20 years there have been numbers of reports of disseminated tuberculosis associated with various blood dyscrasias. These have included leukæmoid blood pictures, tuberculous myelosclerosis, and pancytopenia. A history of sweating and weight loss associated with high fever in a patient with pancytopenia is regarded as being suggestive of a tuberculous ætiology, although some have presented only with symptoms attributable to their blood disorder—that is, symptoms of anæmia or bleeding. Nevertheless, all have appeared acutely ill or have rapidly become so.

The most usual features have been high fever, bleeding, splenomegaly, excessive sweating and weight loss in about that order. Some have had hepatic enlargement, but none to my knowledge have had generalized lymphatic enlargement, though this is known to occur occasionally in cases of miliary tuberculosis. Most patients have been middle-aged males with a short history of several weeks or months.

Diagnosis is difficult, but urgent. It may be confirmed by various methods. Chest X-ray may show a tuberculous focus or miliary mottling. Marrow biopsy may show tubercles or acid-fast bacilli. Chorioidal tubercles should be sought carefully. Liver biopsy showed tubercles in the only case in which it was done, and because of the fact that tubercles are almost always present in the liver in ordinary cases of miliary tuberculosis, I think this is likely to be the most fruitful source of histological proof. However, liver biopsy would be contraindicated in the present case because of the severe bleeding tendency.

By way of interest, a notable feature of many of these cases of disseminated tuberculosis has been the poor cellular reaction around miliary zones of necrosis, together with an enormous profusion of acid-fast bacilli—i.e., the lesions are not true tubercles in the histological sense.

I believe that all the features of this case, with the possible exception of the generalized glandular enlargement, are compatible with acutely disseminated tuberculosis.

Perhaps I have spent an excessive time talking about this condition, which is at most a very uncommon one; but of all the likely diseases it is about the only curable one, and in a patient presenting in this way I think the finding of a pancytopenia would have justified the empiric use of antituberculosis drugs, at least until a more definite diagnosis could be made. Of course we were not to know that we only had three days to make the diagnosis.

In any condition presenting so many and widespread manifestations as we have here, I would anticipate severe censure if I omitted to mention the collagen and allied disorders.

Bleeding due to platelet deficiency is sometimes seen in systemic lupus erythematosus, and it may be the presenting symptom. In addition, enlargement of glands, liver and spleen occurs in a proportion of cases, and prolonged pyrexia is typical.

Against these points we must put the following facts:

1. About 95% of systemic lupus erythematosus occurs in females, usually between 15 and 45 years. For it to affect a man of 59 must be very rare indeed.

2. About 95% of cases have arthritis, usually of rheumatoid type, and joint symptoms are the most usual mode of presentation. We do not have these features in this case.

3. A skin rash occurs in 50% of the cases at some time. These points make systemic lupus erythematosus appear to me a most unsatisfactory diagnosis.

Polyarteritis is to my mind even less likely—some of the less common manifestations are present, but the usual ones such as gastro-intestinal symptoms, cardiac failure, arthropathy or neuropathy are absent.

Because bleeding was such a dominant feature in our patient, it might be useful to consider the possible mechanisms which may have been responsible. These fall into five groups: (i) circulating anticoagulants; (ii) fibrinolysis; (iii) deficiency of one or more clotting factors; (iv) dysproteinæmias; (v) thrombocytopenia.

Circulating anticoagulants have been increasingly recognized lately, and have been classified into several types. Firstly, there is the antithromboplastic type, which may prevent the formation of plasma thromboplastin or perhaps antagonizes it when it is formed. This type is believed to be formed on an immunological basis, and is seen classically in hæmophiliacs who have received repeated blood transfusions or injections of gamma globulin; but it can also occur in disseminated tuberculosis and the collagen diseases. So if this is a case of disseminated tuberculosis, it may explain his severe bleeding.

Secondly, heparin-like substances occur, and these have been described typically in association with malignant lymphomas such as Hodgkin's disease and lymphosarcoma, especially after treatment with radiation or nitrogen mustard. We will discuss these diseases later, but obviously this type of anticoagulant could be present in this case.

Fibrinolysis or acute defibrination occurs classically with severe tissue trauma, and also in women *post partum*. But it can also occur in acute leukæmia, and thus in this case may play a part.

An acquired deficiency of one or more clotting factors is also associated with bleeding. However, this is unlikely, as they usually occur with such conditions as steatorrhœa, obstructive jaundice or liver disease. Abnormal proteins in the blood can cause bleeding by various mechanisms, perhaps by absorption of clotting factors, or by infiltrating the vascular wall and causing damage to endothelium. But in most cases there is the added factor of platelet deficiency —this being especially true in cases of multiple myeloma with severe hæmorrhage and in macroglobulinæmia.

If multiple myeloma is the diagnosis, I would point out that bone pain is absent; splenomegaly is uncommon and lymphadenopathy is even less common. In addition, gross bleeding in multiple myeloma is rare.

On the other hand, macroglobulinæmia is characterized by bleeding, anæmia, recurrent infections and sometimes visual disturbances due to retinal hæmorrhages. Lymphadenopathy with enlargement of liver and spleen is fairly characteristic and is due to infiltration with lymphocytoid cells. It is difficult to exclude macroglobulinæmia, but it is usually less acute.

Finally, thrombocytopenia is perhaps the commonest recognized cause of severe generalized bleeding. If we consider this patient as a case of thrombocytopenic purpura with enlargement of liver and spleen, we are led immediately to the malignant lymphomas such as follicular lymphoma, lymphosarcoma, reticulosarcoma and Hodgkin's disease.

Of these Hodgkin's disease, especially in its acute form, is the most likely to be associated with such severe constitutional symptoms as we see in our patient. Although two-thirds of cases present initially with painless enlargement of glands, the possible clinical presentations are protean, and this is particularly true in the group designated as Hodgkin's granuloma. Fever and excessive sweating often occur early in the course of the disease, especially in those patients presenting with symptoms other than gland enlargement. Marrow involvement, purpura or pancytopenia occurs. Moreover, neurological lesions are sometimes seen, and the commonest site is at the level of the lower thoracic or upper lumbar vertebræ. The most frequent syndromes encountered are paraplegia or nerve-root compression, usually due to extension through an intervertebral foramen from an adjacent paravertebral gland mass, with or without formation of an epidural mass of Hodgkin's tissue. Lesions in the cord itself are almost unknown. Bony invasion of a vertebral body is less common, but may cause sudden paraplegia or sudden root pressure and would explain the sudden onset in this patient. Another possible explanation would be a hæmorrhage into the region of the nerve root. Enlargement of liver and spleen is not often seen in early cases of Hodgkin's disease, but occurs in upwards of 50% of advanced cases. Fever may be of any type or degree and may even occasionally be of the Pel-Ebstein variety. From the clinical point of view, we can hold little against Hodgkin's disease as a diagnosis, except that glands tend to be involved in groups or asymmetrically.

If we take the final two weeks of this man's illness and compare it with a textbook description of acute leukæmia, we find a striking similarity. The acute illness with sore throat, bleeding and anæmia, high fever and mild to moderate enlargement of liver, spleen and glands are all quite typical.

Widespread bleeding is more typical of acute leukæmia than of Hodgkin's disease, and the glands tend to be more diffusely enlarged (if enlarged at all), and are perhaps softer than in Hodgkin's.

Neurological manifestations occur in 25% to 50% of acute leukæmias, and one of the most frequent is cerebral hæmorrhage. In a series of 42 patients with fatal acute leukæmia, 10 died of cerebral hæmorrhage.

In addition, peripheral nerve lesions may occur in much the same way as in Hodgkin's disease by leukæmic infiltrations or hæmorrhage. What of the first symptoms during the first eight months? Did this man have chronic leukæmia which became acute? The physical findings are rather against this—the spleen is usually larger in chronic myeloid leukæmia, and the glands are larger in chronic lymphatic leukæmia, though not invariably. On the other hand, acute leukæmia may be of insidious onset (the so-called preleukæmia phase) especially in older age groups, and may present with pancytopenia without typical leukæmic marrow infiltrates, and this may last for several months or years before frank acute leukæmia supervenes. I think I have mentioned enough conditions now, and my final differential diagnosis includes conditions which I feel can never be diagnosed without histological or pathological examination.

Hodgkin's disease in an acute form or acute leukæmia are high on the list, and I do not believe that you can distinguish these on clinical grounds alone.

The third one would be acute disseminated tuberculosis. If I were to favour any of these, I would think perhaps acute leukæmia was the diagnosis; but I would not be prepared to put any money on it.

DR. W. L. CALOV: The case is now open for discussion and Dr. Francis, I am sure, is prepared to answer any disturbing questions that may be fired at him.

A STUDENT: Could the sciatica be explained on the basis of subperiosteal hæmorrhage?

DR. FRANCIS: Yes, either a hæmorrhage or a space-occupying lesion. We often postulate hæmorrhages into newgrowths to explain the sudden onset of symptoms in patients who we strongly suspect or know have neoplasms. But it is rather disappointing how rarely we find these hæmorrhages. Perhaps sudden œdema may explain the sudden onset of symptoms.

DR. B. ASHLEY: There were only a few purpuric spots on the face, forearms and legs and a few scattered bruises, yet he was bleeding heavily from the kidneys and other places. What does this mean?

DR. FRANCIS: Dr. Elvy might know about that.

DR. R. J. ELVY: Without revealing the diagnosis, the degree of hæmorrhage in this man appears to be out of proportion to the degree of purpura, which, however, is not well defined in the protocol.

In our experience, generally, one associates blood loss from the alimentary and renal tracts with a coagulation defect rather than with thrombocytopenia. However, often in the terminal phases of gross disorder such as leukæmia and marrow hypoplasia, the platelet count is well below 10,000 per cubic millimetre, and we occasionally see gross blood loss such as occurred in this patient, but associated usually with gross purpura and bruising.

DR. J. N. SEVIER: Mr. Chairman, I would like to compliment Dr. Francis on a very erudite exposition of a fascinating case. I must admit that he has thought of everything that I would have considered. I do think that something has been suppressed. In this hospital of ours, a blood count would have been done, even if the patient did die in three days, or was admitted on a long week-end. I feel sure someone looked at his blood, and that this has been suppressed or left out through a typographical error. Similarly, I feel sure that someone scraped the soles of his feet after the onset of the cerebral catastrophe and before he became areflexic. The Babinski phenomenon is conspicuous by its absence from the protocol, and this might have been of some interest. However, undoubtedly his blood was looked at and would go a fair way to the answer. I agree with Dr. Francis—the most likely diagnosis is acute leukæmia, rather than Hodgkin's disease, aplastic anæmia or subacute bacterial endocarditis. Dr. Francis likewise emphasized that the possibility of miliary tuberculosis would have justified a therapeutic trial had he lived longer than three days.

DR. B. P. BILLINGTON: There is a story of bone-marrow failure with a large spleen and liver, and one wonders whether there might be myeloid metaplasia in these organs. If so, how do we account for the enlarged lymph nodes? I cannot—and I must fall back then on some form of reticulosis which is infiltrating liver, spleen, bone marrow and lymph nodes. I would not like to guess without histological or hæmatological evidence what sort of reticulosis is involved.

DR. CALOV: Before we go further, we might ask Dr. Francis, if this patient had been admitted to one of his beds and did not die before Dr. Francis was able to see him, what investigations he would order.

DR. FRANCIS: I would not know that this patient would die in three days, but I hope I would feel that this was a distinct possibility. Firstly, I would have a full blood examination performed, which would give a good chance of diagnosing acute leukæmia. If this were the diagnosis,

then there would be good grounds for steroid therapy. If acute leukæmia were not obvious but a pantocytopenia was present, then I would start immediately on antituberculosis therapy. A chest X-ray would be desirable, as would marrow aspiration with some smears stained for acid-fast bacilli. Subsequent tests would depend on the results of these initial tests.

DR. CALOV: I must confess that acute leukæmia was the only thing of which I thought. I still cannot escape from that, despite the very sound and attractive propositions of Dr. Francis. I do not believe that the pustules on the lips were pustules at all. I think they were sores that you commonly see in acute leukæmia. There is bleeding into the skin with subsequent necrosis of the epidermis. Because of the poor resistance to infection, these sores become septic. I cannot think of any other disease that would cause them.

The other thing is the generalized lymph-gland enlargement. In Hodgkin's disease you would hope to have a mass of glands somewhere. Incidentally, look at all the dreadful disasters that happen when a person goes to the commode. He goes there and he cannot do anything, that is one disaster. He does too much, and that is another disaster. He tries too hard when he is there, and an infarcted area of his heart explodes. In a big series of sudden deaths of young men in the United States Army during the war, the majority occurred at the latrines. I suppose the hard fare, the change in life, etc., was responsible for constipation; the fellow goes to the latrine, strains hard and goes red in the face, and he drops dead.

And now we might have the answer.

Pathological Report.

The body was that of a man about 60 years of age. There were a few scattered petechiæ about the face and upper chest, and there was mild generalized enlargement of the lymph nodes. There were no abnormalities in the mouth and naso-pharynx other than pallor.

The lungs and pleural cavities showed no special features; the heart was moderately enlarged, but no abnormalities were found in the valves, and there was no evidence of endocarditis. The coronary arteries showed minimal atheroma.

The liver was firm, smooth, pale and enlarged. The spleen was about twice its normal size, and was soft and pale.

Both kidneys showed extravasation of blood beneath the mucosa of the renal pelvis, and some blurring of the distinction between cortex and medulla.

In the stomach and small intestine there were some scattered petechiæ, while the terminal ileum had some apparently healed ulcers. The appendix had been removed. There were no enlarged mesenteric lymph nodes. The brain showed flattening of the gyri. The cerebral hemispheres were normal on section, but in the cerebellum there was a gross hæmorrhage extending into both cerebellar hemispheres.

The section of the bone marrow shows that there are no fat spaces left. In other words, it is a grossly hypercellular bone marrow and its cellular composition is rather uniform. Most of the cells are large and immature, and there are very few megakaryocytes. The cerebellar section is from the cortex. A lot of the hæmorrhage in this slide is actually subarachnoid, and there is a great mass of nucleated cells in amongst the red cells. These are similar to the cells in the bone marrow. I should have said that there was a blood count done before death, which showed 256,000 white cells per cubic millimetre, of which 93% were blast cells. The hæmoglobin was 8·6 grammes per 100 ml.

The kidney shows hilar hæmorrhage or infiltration in the peripelvic fat such as we saw in the brain. There are so many nucleated cells present in the blood that you cannot be sure whether this is a hæmorrhage or an infiltration. Perhaps it is both. The other feature in the kidney is some evidence of preexisting hypertension. Some of the arteries show thickened walls with reduplicated internal elastic laminæ, and some of the afferent arterioles show quite marked hyalinization.

The heart does not show any fibrosis, very little coronary artery disease and no valvular damage. The striking feature is the packing of all the small blood vessels with immature white cells—in some places they form rows in the capillaries and I wonder whether they may contribute to damage by blocking the capillaries, as they are a lot larger than the red cells. The lung section shows leukæmic infiltration. The liver also shows typical leukæmic infiltration and some fatty change. There are lots of immature cells in the sinusoids and also infiltrating the portal tracts. The spleen is packed with immature white cells. The lymphoid follicles are hardly to be found—it is just a mass of cells very similar to those in the bone marrow. There are some ulcer-like lesions in the ileum; the muscle wall shows marked infiltration and in the mucous membrane there is an ulcer which may have contributed to the bleeding.

In summary, then, there was an acute leukæmia of blast-cell type with terminal cerebellar hæmorrhage, and some evidence of preexisting hypertension.

DR. P. LEWIS: Was there an area of leukæmoid infiltration to account for the sciatica?

DR. PALMER: I regret I cannot answer that question.

DR. CALOV: It was the commode.

I think you will agree that this has been a very interesting case and beautifully presented.

Correspondence.

AN AUSTRALIAN MEDICAL ASSOCIATION.

SIR: The Roman emperor Caligula is reported to have wished that the Roman crowd had but one neck. Is the medical profession of Australia providing a collective neck for the Federal Government? I feel that this is just what the proposed Australian Medical Association will provide with its centralization of power.

I have heard that there is a likelihood of the Federal Council being located at Canberra where it would be beset by the insidious influences of that hotbed of bureaucracy and socialized planning.

If there has to be an Australian Medical Association, the safe way would be for the State branches to remain sovereign bodies. The sorry history of the rise of Canberra with the decline of the States of the Commonwealth should be a lesson for us. Surely the democratic way would be for all but very minor decisions to be made by the individual State branches with the Federal Council acting merely as a sort of liaison body.

I feel that if we consent to the constitution of the Australian Medical Association as proposed, we shall be a step nearer to Government control of the profession.

Yours, etc.,

W. T. WHITBY.

45 Albion Street,
Waverley, N.S.W.
December 23, 1960.

MEDICAL MORBIDITY IN A GENERAL HOSPITAL.

SIR: I join with Dr. David Wallace (MED. J. AUST., November 12, 1960) in expressing my appreciation of the article by Professor Saint on medical morbidity in a general hospital (MED. J. AUST., October 15). It is interesting to note that 46% of patients admitted to the Royal Perth Hospital were over the age of sixty years. When it is realized that a large number of these are long-stay patients, it is appreciated why Professor Saint asks: "Why is it necessary to keep so many patients in a teaching hospital for so long a period?"

Long-stay patients should not be nursed in the acute wards of a teaching hospital. It must be depressing to a chronically ill elderly patient to see the younger patient with his strong natural powers of resistance and recuperation being discharged from hospital while he remains. He realizes when the doctor has lost interest in him, and becomes depressed and deteriorates rapidly when he is transferred to another institution because his bed is wanted.

It is my opinion that patients suffering from prolonged illnesses should be nursed in separate wards in a general hospital grounds, and for this reason a geriatric unit which will incorporate a day hospital is being built within the grounds of the Princess Alexandra General Hospital, South Brisbane, where such patients will be kept while they are receiving active treatment. From here, patients will be discharged to their homes or to other institutions, depending on their medical condition.

I cannot agree with Dr. Wallace that geriatrics is an entity, if by this he means it is a specialty as is cardiology.

Every doctor, particularly the general practitioner, must be a geriatrician. It is true we know little about the prevention of the diseases which tend to be long-term illnesses, so little can be done in this regard. Periodic examinations after the age of forty, advice in nutrition and the avoidance of stress can assist in the prevention of physical and mental breakdowns. It is the general practitioner, who sees the patient for his various illnesses throughout life, who can give advice in regard to these matters, and if he has a knowledge of the problems of aging and the aged, an understanding of how they get that way, and that physiological changes in tissues in the course of aging are not pathological conditions of mature tissues, he might be able to delay the onset of diseases of old age, and when they do occur to treat his elderly patients without the advice of a specialist geriatrician.

The best way he can obtain this knowledge is as an undergraduate, so the question is one for the medical faculties of our universities.

Yours, etc.,

H. W. NOBLE, M.B., B.S., M.L.A.,
Minister for Health and Home Affairs.

Department of Health and Home Affairs,
William Street,
Brisbane, Queensland.
December 23, 1960.

THE MERRY CHRISTMAS GAMBIT.

SIR: Christmas is here again, and through the post have been coming Christmas cards from Macquarie and Collins Streets. The one in front of me is typical—greetings and all good wishes for the coming year from Dr. and Mrs. So-and-so with a Macquarie Street address. (Does his wife live in Macquarie Street?) I have never met Dr. So-and-so (or his wife), though I received a letter from him two years ago after a patient of mine had asked to be referred to him.

Surely the usual report one receives from a consultant with its "thank you for letting me see Mr. Smith" is sufficient. Except where it is an exchange between real friends, the Christmas card appears to mean "keep my name in mind and send me plenty of patients in 1961". It makes me sick.

Yours, etc.,

PRIG.

Wagga Wagga,
New South Wales.
December 23, 1960.

THE POST-MORTEM RECTAL TEMPERATURE IN SUDDEN DEATH IN INFANTS.

SIR: From time to time in investigating sudden and unexpected deaths in infancy where the infant has just been found dead in his cot, the medical practitioner who has been called has taken the rectal temperature after death. In some instances over the years it has been brought to my notice that the post-mortem rectal temperature was 103°, or 104° or 105° F., a very useful observation to help the pathologist who is subsequently asked to try and determine the cause of death.

One wonders whether it would be possible for more of these observations to be made and the information forwarded to assist the pathologist. Some valuable data could be gathered in this way.

Yours, etc.,

K. M. BOWDEN,
Senior Government Pathologist.

University of Melbourne,
Department of Medical Jurisprudence,
C/- Coroner's Office,
Flinders Street,
Melbourne.
December 30, 1960.

PROFESSORSHIPS OF "ANÆSTHESIA".

SIR: Oliver Wendell Holmes, following W. T. G. Morton's demonstration of the anæsthetic properties of ether in 1846, recommended that the state produced — senselessness — should be called anæsthesia, and that the agent employed should be called the anæsthetic. Further, the term anæsthetic would also satisfy adjectival requirements. Unfortunately he did not extend his second definition to cover the study and practice of the new development, which obviously would constitute the science of anæsthetics.

Since that time a misuse of the term "anæsthesia" has become widely established in North America, even in England, and, of course, in Australia. Thus we read and hear frequently of departments and directors of senselessness, of registrars in senselessness, and now of projected associate professorships of senselessness at the two medical schools in New South Wales. Advertisements that appeared in your issues of July 16 and December 24, 1960, exhibit this defect.

The realization that the highly important speciality of anæsthetics is at last to receive suitable, even if only partial, academic recognition is deeply gratifying to all concerned, especially those who have envisaged such progress for years. Must our centres of learning, however, condone in this regard a grievous error of terminology, even if this has been long accepted by wide usage? Is it excessively pedantic to uge that these new appointments be correctly designated associate professorships of anæsthetics? Perhaps the professor of English or his equivalent at each university concerned should be consulted in the matter.

Yours, etc.,

S. V. MARSHALL.

"Harley",
143 Macquarie Street,
Sydney.
December 28, 1960.

A CASE OF POISONING WITH "TOFRANIL".

SIR: It seems desirable to report in brief our recent experience with a case of poisoning with the drug "Tofranil" (Stoller[1]). A fatal case of poisoning with this drug (in childhood) was reported recently in your Journal (Noack[2]).

J. T., aged two years, was admitted at 2 p.m. on December 3, 1960. She had been given some three hours previously between 15 and 20 tablets of "Tofranil" by a sibling, aged four years, in response to a request for "lollies". The sibling, who was being treated with this drug in a dose of one tablet twice daily, climbed to a cupboard to obtain the tablets. The patient was unconscious and convulsing on admission. The convulsions were controlled with paraldehyde, subsequent to which her cerebral condition gradually, but progressively, improved.

In addition, a persistent cardiac irregularity was observed. This comprised irregular but frequent dropping of beats. An electrocardiogram revealed a bizarre pattern. There were bursts of rapid beats, in which the ventricular complexes were mostly quite abnormal and grossly widened, up to 0·16 sec. in duration. There was also deformity of the *S-T* segments. The rate of these bursts lay between 120 and 150 per minute. Some cycles appeared to represent sinus rhythm with intraventricular block, but others could have been of ventricular origin. This electrocardiographic pattern persisted almost constantly until 12 hours after admission, when sinus rhythm returned permanently. It was interrupted prior to this only by a brief period of obvious sinus rhythm with intraventricular delay (0·12 sec. complexes) and by one of coupled broad complexes of two different patterns.

The broadening of the ventricular complexes progressively decreased over the next few days. By the time of discharge on December 9, 1960, the complexes were less than 0·06 sec. in duration. Despite the arrhythmia, the circulatory status of the patient fortunately remained reasonable throughout.

The arrhythmia and conduction disturbance are presumably due to a direct action of "Tofranil", in excessive dosage, on the myocardium. This occurrence is reported for the benefit of others who may encounter similar overdosage.

Yours, etc.,

J. F. CONNELLY,
A. W. VENABLES.

The Royal Children's Hospital,
Melbourne.
December 28, 1960.

A RESPIRATORY PROTECTION CODE.

SIR: I deplore the statement in "Current Comment", in the Journal of December 17, 1960, that the most effective measure for the prevention of industrial respiratory disease is the

[1] MED. J. AUST., 1960, 1: 412 (March 12).
[2] MED. J. AUST., 1960, 2: 182 (July 30).

wearing of respiratory protective devices. The necessity for the wearing of a respiratory protective device is, in itself, a confession of failure; it indicates that some dangerous substance has been liberated into the breathing zone of the worker, and now has to be removed from the air that he breathes by some process of filtration.

Industrial respiratory disease is due to the inhalation of dust, mist, vapour or gas of a toxic nature. Its prevention depends, in the first place, on ensuring that substances of this type are not liberated into the breathing zone; in other words, on engineering measures. These may be: (i) the use of a completely enclosed process; (ii) the use of a less toxic substitute; (iii) the intelligent use of exhaust ventilation. Only when all of these have been tried, and protection is still not adequate, or where, for some reason other than expense, they are inapplicable, is one justified in advising reliance on personal protective devices.

I remind you of the famous words of Legge: "Unless and until the employer has done everything—and everything means a great deal—to protect the workman, the workman can do next to nothing to protect himself." The provision of protection, by engineering methods, against risk of inhalation is the responsibility of the employer. Until that responsibility is accepted to the fullest possible extent, it is dangerous to encourage the use of respiratory protective devices.

Yours, etc.,

H. M. T. MURRAY,
Director of Public Health.

Department of Health Services,
Tasmania,
Division of Public Health,
Hobart.
January 5, 1961.

THE PROBLEM OF ALCOHOLISM.

SIR: I am becoming more and more concerned with much of the Press publicity that is being given to the problem of "alcoholism". That the effects of alcohol on the human organism undoubtedly constitute a very real problem, and thus a challenge, to our community is beyond dispute. However, whilst it is true that from one point of view any publicity is valuable in that it highlights the various aspects of the total problem, it would seem that the medical profession ought to endeavour to see that the propaganda remains essentially accurate, and that undue, or untrue, claims are not made either explicitly or by implication.

The problem of "alcoholism" is often glibly spoken of without in any way defining what is meant, and various statistics quoted that can only be considered as valueless in the context usually given. The problem of whether "alcoholism" is a symptom or a disease requires clarification, although it is accepted that the more subtle aspects of this question need not be overvalued. Nevertheless, claims that "alcoholism" (usually to be interpreted as "chronic alcoholism") is a "disease", an "allergy", an "obsession", etc., without any adequate qualification is (*a*) as yet without validity, (*b*) unlikely to be true from clinical experience, and (*c*) is undesirable if worthwhile research is to be carried out in this field.

Another considerable cause for concern is to be found in the implicit claims being made regarding the present position of the treatment of "alcoholism". At the present time it would seem that at one level of argument "alcoholism" is a symptom, and thus the treatment required has to be multilateral and multidisciplinary, each case to be appraised and dealt with individually. One case may require a great deal of environmental manipulation and case work by a social worker, another requires treatment primarily directed towards the amelioration of a psychosis or epilepsy, etc., whilst another may benefit from psychotherapy at various levels, whilst another again may be satisfactorily helped with some tranquillizer, and all these cases benefit from the support of Alcoholics Anonymous—if they are able to initially accept the concepts and techniques of the organization. A fact that has to be accepted at present is that many "alcoholics" cannot be helped, as our knowledge and understanding of the problem is too limited. In this group any changes produced by any régime are transient in the extreme, so that it is reasonable to make the statement that at this present time they are "nearly incurable". If this point of view be accepted, then it becomes ludicrous and misleading to speak of "treatment for alcoholics" with the implied corollary that all required is that the "alcoholic" be got to a treatment centre and all will be well.

Another problem that might be alluded to briefly concerns the claims made regarding the success of various therapeutic régimes—a matter of immediate concern to the profession. Three points may be made. Firstly, many "alcoholics" have natural remissions for varying periods of time. Secondly, many "alcoholics" who seek treatment will improve immediately they receive some understanding and sympathy—only to break down sooner or later. These two points make claims, such as that by Speight[1] regarding "Librium", valueless from a methodological point of view (no controls, etc.), and so previous as to suggest a lack of clinical knowledge of the problem. The third point relates to the not inconsiderable number of "alcoholics" that relinquish alcohol only to find satisfaction from other drugs (James[2]).

By all means let us have community education regarding the problems produced by alcohol, but let us see that the education is soundly based on facts and with a minimum of emotional overtone. This can in part be achieved by the medical profession refusing to be "bulldozed" by public relations officers and enthusiastic persons and organizations into allowing wild generalizations doing service for facts and reasonable hypotheses and theories—the hypotheses and theories being recognized as such, and not being made to appear as something very much more certain.

Yours, etc.,

ALLEN A. BARTHOLOMEW.

Mental Hygiene Branch
(Department of Health),
Alexandra Parade Clinic,
6 Alexandra Parade,
Fitzroy, Victoria.
December 30, 1960.

RISING COSTS AND MEDICAL FEES.

SIR: Some months ago a member of the British Medical Association in New South Wales wrote to THE MEDICAL JOURNAL OF AUSTRALIA advocating a large reduction in medical fees. This later achieved wide publicity in the daily Press. Unfortunately this member bears the same name as I, and his remarks have been ascribed to me. One other member has rebutted his statements, but apparently looked up my name in the "Medical Directory" as having qualified 50 years ago, and implied that I must be senile to have such views. I find that this opinion of me has gained ground, and I desire to point out that this is a case of mistaken identity. I do not believe that the present consulting and visiting fees are excessive. About 100 years ago the Port Phillip Medical Association ruled that the normal fee for a consultation should be 10s. 6d., and so it was for 75 years, and only lately has been raised to £1. Surely no one will cavil at this small increase when everything else has skyrocketed. What is a glaring anomaly is the pittance that is paid by the Government for visits by Repatriation and other pensioners of the Commonwealth. Our requests for an increase have been met with flat refusal. The serious side of this refusal is that within striking distance we may be faced with a national health scheme based on these meagre fees, or a salaried medical service also calculated on them.

It will not be enough for our members to say: "What has the B.M.A. done for us or what is the B.M.A. doing?" Every doctor will have to be a public relations officer in himself, as is suggested by the new Victorian President of the B.M.A., Mr. Geoffrey Newman-Morris. Little consideration of the doctor-patient relationship will be given by the political parties.

The latest issue of *Commentary* (U.S.A.) discloses that both Mr. Nixon and Senator Kennedy have declared against the system of medical care now developed in U.S.A. This system is based on the Blue Cross, and, in turn, our benefit associations in Australia have taken the Blue Cross as the basis of their organization.

Every Australian doctor should re-read our pamphlet "If Any Political Party", and act on it.

Yours, etc.,

D. ROSEBY.

339 Church Street,
Richmond Hill,
Victoria.
January 4, 1961.

[1] MED. J. AUST., 1960, 2: 741 (November 5).
[2] MED. J. AUST., 1960, 2: 398 (September 3).

Post-Graduate Work.

THE POST-GRADUATE COMMITTEE IN MEDICINE IN THE UNIVERSITY OF SYDNEY.

Course in the Art of Teaching.

THE Post-Graduate Committee in Medicine in the University of Sydney announces that a further course in the art of teaching will be held under the supervision of Dr. K. S. Harrison, on Saturday, February 18, 1961, in the Scot Skirving Lecture Theatre of the Royal Prince Alfred Hospital. The course, which is intended to revise and amplify the material presented in the previous week-end courses, will be conducted by Dr. S. W. Cohen, Director of Advisory Services, University of Sydney, and Dr. Anna Hogg, of the Sydney Teachers' College.

There will be three sessions, as follows, the first commencing at 9.30 a.m.: Session I: revision by Dr. Cohen and Dr. Hogg of the main points covered in earlier courses, perhaps illustrated with a film; Session II: presentation of a film on discussion techniques, leading to consideration of principles of small group teaching; Session III: discussion of the bedside teaching situation, based on a tape recording of an undergraduate session.

The fee for attendance will be £1 1s., and those wishing to enrol should make application to the Course Secretary, The Post-Graduate Committee in Medicine, Herford House, 188 Oxford Street, Paddington, before February 1, 1961. Telephone: FA 0671.

ROYAL PRINCE ALFRED HOSPITAL: EAR, NOSE AND THROAT DEPARTMENT.

Seminar Programme, 1961.

THE staff of the ear, nose and throat department of the Royal Prince Alfred Hospital, Sydney, will conduct a seminar on the second Saturday of every month (except January) at 8 a.m. in the Scot Skirving Lecture Theatre. The main speaker will not exceed forty minutes, and there will be a discussion at the conclusion of his remarks. All medical practitioners and clinical students are invited to attend.

At the next seminar, to be held on February 11, 1961, Dr. J. H. Lancken will speak on "Bilateral Abductor Palsy of the Larynx".

SURGICAL SEMINARS AT ST. VINCENT'S HOSPITAL, SYDNEY.

A SURGICAL SEMINAR will be held at St. Vincent's Hospital, Sydney, on Monday, February 13, 1961, at 5.15 p.m., in the lecture room on the fifth floor. Mr. R. D. Condon will speak on "Minor Rectal Diseases".

MEDICAL SEMINARS AT ST. VINCENT'S HOSPITAL, SYDNEY.

A SERIES of medical seminars will be held at St. Vincent's Hospital, Sydney, on the second and fourth Tuesdays of each month, commencing on February 14, 1961. A medical grand round will be held on the first and third Tuesdays, commencing on February 7. Each session will commence at 1.15 p.m. and continue until 2 p.m. The programme for the first six months is as follows: February 14, "The Metabolism of Alkaline Phosphatase", Dr. N. Korner; February 28, "Applications of Aldosterone Antagonists", Dr. A. Jose, Director of the Hallstrom Institute of Cardiology; March 14, "Small Bowel Biopsy", Dr. W. Hennessy; March 28, "Iron Kinetics and Hæmoglobin Synthesis in Human Subjects Studied with Fe 59", Dr. J. McRae, Senior Lecturer in Medicine (Radiobiology), University of Sydney; April 11, "Klinefelter's Syndrome", Dr. J. Farrell; April 25, "Problems in Aviation Medicine", Dr. A. Seldon; May 9, "Auscultation of the Heart", Dr. G. Michell; May 23, "Leukæmia", Dr. P. Lamond; June 13, "Modern Trends in the Management of Epilepsy", Dr. W. Burke; June 27, "Pleural Effusion", Dr. P. Maloney.

ROYAL HOSPITAL FOR WOMEN, PADDINGTON.

Week-End Course in Obstetrics and Gynæcology.

A week-end course in obstetrics and gynæcology will be held at the Royal Hospital for Women, Paddington, N.S.W., on February 25 and 26, 1961. Professor L. W. Cox, from the University of Adelaide, is Guest Professor. Any member of the medical profession is invited to attend. Further details may be obtained from Dr. D. R. Sheumack, Honorary Secretary, Clinical Society, Royal Hospital for Women, Paddington.

THE MELBOURNE MEDICAL POST-GRADUATE COMMITTEE.

PROGRAMME FOR FEBRUARY, 1961.

THE Melbourne Medical Post-Graduate Committee announces the following programme for February, 1961.

Anatomy.

On February 13, classes will commence at the Anatomy Department, University of Melbourne, for candidates for M.S., F.R.A.C.S., F.F.A.R.A.C.S., M.G.O., D.O., D.L.O., D.P.M., D.A., D.D.R., D.T.R. and D.C.R.A. They will be held at 2.15 p.m. on Mondays and Wednesdays, and continue for five months. (The times of D.P.M. classes, which will vary, will be announced, but chiefly they will be at 12.45 and 2.15 p.m.) The fee is £21, and enrolments, on the special form, should be received by the Post-Graduate Committee by January 31, 1961.

Physiology.

On February 27, classes will commence at the Physiology Department, University of Melbourne, for candidates for M.D., M.S., F.R.A.C.S., F.F.A.R.A.C.S., M.G.O., D.O., D.L.O., D.A., D.D.R. and D.P.M. These will be held on Mondays and Wednesdays, at 3.45 p.m., continuing for five months. The fee is £21, and enrolments, on the Committee's form, should be received by February 13.

Pathology.

Pathology classes for M.D., candidates, and as a basic course for Part II of the M.G.O. and diplomas, will begin on March 6.

Gynæcology and Obstetrics Refresher for Recent Graduates.

A full-time course, consisting of lectures, demonstrations and ward rounds, will be conducted at the Royal Women's Hospital, Melbourne, by members of the hospital staff from January 31 to February 10. Full residence will be available at the hospital. The tuition fee for the whole course is £10 10s., payable to the Committee; board and lodging is at £7 10s. per week, payable to the hospital. Commencement of the course depends on receipt of a satisfactory number of enrolments by January 19.

Country Courses.

Warragul.—On February 4, at the West Gippsland Base Hospital, Warragul, the following course will be given: 2.30 p.m., "Diabetes and Its Management", Dr. J. R. Stawell; 4 p.m., "Skin Diseases in General Practice", Dr. J. Summons; 7.30 p.m., "Collagen Diseases", Dr. R. Fraser. Dr. J. E. Joseph, 237 Princes Highway, Morwell, is the Honorary Secretary of the Gippsland Sub-division.

Ballarat.—On February 23, at Craig's Hotel, Ballarat, at 8.15 p.m., Dr. J. Madigan and Dr. R. Motteram will present a symposium on "Generalized Lymphadenopathy: Diagnosis, Pathology and Treatment". The local secretary is Dr. I. C. Goy, 22 Ripon Street, Ballarat.

Bendigo.—On February 24, at Bendigo, at 8 p.m., Dr. T. H. Hurley will speak on "Pyrexia of Unknown Origin". Dr. M. Clark, 98 Mitchell Street, Bendigo, is the local secretary.

Mortlake.—On February 25, at Mortlake, Dr. James Gardiner will discuss "Myocardial Ischæmia; Recent Work in Diagnosis and Treatment", and Dr. R. M. Rome will discuss "Obstructed Labour". The local secretary is Dr. R. R. Sobey, 6 Spence Street, Warrnambool.

Fees.—The fees for the above courses are at the rate of 15s. per lecture, but those who have paid an annual subscription to the Committee are invited to attend without further charge.

Flinders Naval Depot.

On February 15, at Flinders Naval Depot, at 2.30 p.m., Dr. A. Goble will lecture on a subject to be announced. This lecture will be given by arrangement with the Royal Australian Navy.

Overseas Visitors.

Dr. Desmond Curran, psychiatrist, of London, will lecture on "Psychiatry in General Practice" in the Medical Society Hall, on Thursday, February 2, at 8.15 p.m.

Professor Sheila Sherlock, of the Department of Medicine, Royal Free Hospital, London, will visit Melbourne from February 19 to 23, and at 8.15 p.m. on Tuesday, February 21, in the Medical Society Hall, will lecture on "Hepatic Coma".

The fees for the above-mentioned lectures are at the rate of 15s. per lecture, but those who have paid an annual subscription to the Committee are invited without further charge.

Dr. Geraint James, of London, will also lecture during this period on a subject and on a date to be announced.

The following two visitors are coming to Melbourne under the sponsorship of Geigy Limited, and all members of the medical profession are invited to their lectures without charge. Monday, February 27, Dr. L. G. Kiloh, of the Department of Psychological Medicine, Newcastle, U.K., subject to be arranged; Thursday, March 2, Dr. Dudley Hart, physician and rheumatologist of Westminster Hospital, London, subject to be announced. The lectures will be held at the Medical Society Hall at 8.15 p.m.

Information.

The address of the Melbourne Medical Post-Graduate Committee is 394 Albert Street, East Melbourne. Telephone: FB 2547.

Notes and News.

Association of Sheltered Workshops.

According to the newsletter of the Australian Advisory Council for the Physically Handicapped (July to November, 1960), an Association of Sheltered Workshops has been recently established in New South Wales. Consisting of representatives from organizations conducting, about to conduct or interested in sheltered workshops, arranged in various grades of membership, the new Association has the following broad aims: (i) to develop workshops in an orderly manner; (ii) to establish quite clearly what a workshop is; (iii) to develop a community attitude so that the employment of handicapped persons is the accepted thing; (iv) to establish with employer groups the desirability of sheltered workshops; (v) to do the same with employee groups; (vi) to explore and exploit any avenues for work; (vii) to negotiate with the Government for alteration to legislation to facilitate the smoother running of workshops; (viii) to negotiate with the Government for financial assistance for sheltered workshops; (ix) to stimulate community activity for the establishment of regional workshops; (x) to have facilities for transmitting "know-how" for the development of regional workshops.

Sir Kenneth Coles, immediate Past President of the International Society for the Welfare of Cripples, has been elected President of the Association. Mr. Hugh Bedwin, Administrator of the Civilian Maimed and Limbless Association, has been appointed Chairman. Inquiries about the Association should be addressed to the Honorary Secretary, Miss Gwenn Forsythe. The office of the Association is at Chalmers and Bedford Streets, Sydney.

The Problem of Venereal Disease.

The Minister for Health, Dr. D. A. Cameron, has issued the following statement on venereal disease. He stated that he was confident that practical steps to meet the problem of the increase in venereal disease in Australia would emerge from the discussions undertaken by the National Health and Medical Research Council. Individual members of the Council, and medical organizations associated with it, had undertaken to examine in detail facts and recommendations concerning the incidence of those diseases outlined in a report presented to the Council by a committee of Commonwealth and State Government medical officers. The report stated that notifications of syphilis in Australia had increased from 459 cases in 1954 to 664 in 1959, and of gonorrhœa from 1944 cases in 1954 to 4128 in 1959. Members of the Council would study the

DISEASES NOTIFIED IN EACH STATE AND TERRITORY OF AUSTRALIA FOR THE WEEK ENDED DECEMBER 17, 1960.[1]

Disease.	New South Wales.	Victoria.	Queensland.	South Australia.	Western Australia.	Tasmania.	Northern Territory.	Australian Capital Territory.	Australia.
Acute Rheumatism	..	2(1)	..	..	..	..	..	..	2
Amœbiasis	..	..	..	..	2(2)	..	..	..	2
Ancylostomiasis	2	..	..	..	..	..	3	..	5
Anthrax	..	1(1)	..	..	..	..	..	..	1
Bilharziasis	..	..	..	..	..	..	..	..	..
Brucellosis	..	..	..	..	..	..	..	..	..
Cholera	..	..	..	..	..	..	..	..	..
Chorea (St. Vitus)	..	..	..	..	..	..	..	..	..
Dengue	..	..	..	..	..	..	..	..	7
Diarrhœa (Infantile)	7	10(8)	3(3)	..	..	..	4	1	25
Diphtheria	..	1	..	..	..	..	..	..	1
Dysentery (Bacillary)	..	1(1)	1(1)	..	5(5)	..	2	..	9
Encephalitis	..	..	..	..	..	..	..	..	..
Filariasis	..	..	..	..	..	..	..	..	..
Homologous Serum Jaundice	..	..	..	..	..	..	..	..	..
Hydatid	..	1	..	..	..	..	..	..	1
Infective Hepatitis	189(68)	66(33)	16(5)	32(13)	13(5)	..	..	6	322
Lead Poisoning	..	..	..	..	..	..	..	..	..
Leprosy	..	..	..	..	..	..	1	..	1
Leptospirosis	..	2(1)	..	..	..	..	..	..	2
Malaria	..	1(1)	..	..	..	..	..	..	1
Meningococcal Infection	..	..	..	..	..	..	1	..	1
Ophthalmia	..	..	..	..	..	..	..	..	..
Ornithosis	..	..	..	..	..	..	..	..	..
Paratyphoid	..	..	..	..	..	..	..	..	..
Plague	..	..	..	..	..	..	..	..	..
Poliomyelitis	..	..	..	..	..	2(1)	..	..	2
Puerperal Fever	..	4	..	..	..	..	1	..	5
Rubella	..	12(7)	..	..	2(2)	..	..	..	14
Salmonella Infection	..	..	..	1	..	..	..	..	1
Scarlet Fever	14(4)	11(9)	..	1(1)	..	1(1)	..	..	27
Smallpox	..	..	..	..	..	..	..	..	..
Tetanus	..	..	1	..	..	..	..	..	1
Trachoma	..	..	..	..	182	..	..	..	182
Trichinosis	..	..	..	..	..	..	..	..	..
Tuberculosis	25(13)	16(11)	9(4)	1(1)	7(5)	4(3)	..	..	62
Typhoid Fever	..	..	..	..	..	..	..	..	..
Typhus (Flea-, Mite- and Tick-borne)	..	..	..	..	..	..	..	..	..
Typhus (Louse-borne)	..	..	..	..	..	..	..	..	..
Yellow Fever	..	..	..	..	..	..	..	..	..

[1] Figures in parentheses are those for the metropolitan area.

recommendations in the report and discuss them at the next meeting, in May, 1961. That meeting would submit recommendations for legislative and other action to the Commonwealth and State Governments. The medical officers' committee had suggested that there should be an improved standard of diagnosis of early infection, to expedite medical treatment. That could perhaps be assisted by a reference laboratory, established for the specific purpose of undertaking blood tests of a special type not at present performed in Australia. The N.H.M.R.C. had referred this proposal to the College of Pathologists for a report on its practicability. Medical students should be given special instruction on diagnosis and treatment, and specialized information should be made available to the medical profession generally. Laboratories in all States should undertake tests to detect increasing resistance to penicillin among gonococcal strains, and medical practitioners should be asked to report promptly all cases failing to respond to standard penicillin therapy.

Dr. Cameron further said that the medical officers' committee laid great stress on the need for general practitioners to take advantage of their opportunities to persuade patients to have the contacts, or sources of infection, submit themselves for treatment. The Committee stressed the fact that treatment, once commenced, should be continued until a cure was effected. It recommended that the penalty for discontinuance of treatment before discharge should be increased. The Committee also urged that steps be taken to impress on the medical practitioner his obligation to cooperate in the notification of disease and in the surveillance of his patient's treatment.

An Advance in the Training of Psychoanalysts in Australia.

It has now been approved by the Institute of Psychoanalysis, London, and the British Psycho-analytical Society, that in the training of psychoanalysts in Australia, Dr. Clara Geroe, Melbourne, be joined by Dr. F. W. Graham, Melbourne, and Dr. H. M. Southwood, Adelaide. The training programme extends to four years. It involves, besides individual analysis, systematic courses in psychoanalytic theory and technique and case supervision. Candidates for training may apply to Dr. Geroe, Melbourne Institute for Psycho-analysis, 111 Collins Street, Melbourne, or to Dr. H. M. Southwood, Gawler Chambers, 188 North Terrace, Adelaide. Candidates who successfully complete the course are recommended for qualification as pschoanalysts by the Training Committee of the Institute of Psycho-analysis, London.

Notice.

ST. VINCENT'S HOSPITAL, SYDNEY: GASTRO-ENTEROLOGY UNIT.

A MEETING of the Gastro-Enterology Unit of St. Vincent's Hospital, Sydney, will be held on Thursday, January 26, 1961, at 5.30 p.m. There will be a presentation of several patients. All medical practitioners are invited to attend.

Nominations and Elections.

THE undermentioned have applied for election as members of the New South Wales Branch of the British Medical Association:

Higgins, Vincent William, M.B., B.S., 1960 (Univ. Sydney), 53 Gardeners Road, Kingsford.

Piper, Brian James, M.B., B.S., 1959 (Univ. Sydney), 13 Margaret Street, Fairlight.

Plunkett, Edward Henry, M.B., B.S., 1960 (Univ. Sydney), Greggs Road, Kurrajong.

Frey, John, M.D., 1952 (Univ. Bonn); Provisional Registration, N.S.W., 1961, 2 Bayview Street, Bronte.

Deaths.

THE following death has been announced:

EAST.—Edwin Charles East, on December 21, 1960, at Fremantle, Western Australia.

Diary for the Month.

JANUARY 24.—New South Wales Branch, B.M.A.: Medical Politics Committee.
JANUARY 25.—Victorian Branch, B.M.A.: Branch Council Meeting.
JANUARY 27.—Queensland Branch, B.M.A.: Council Meeting.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment mentioned below without having first communicated with the Honorary Secretary of the Branch concerned, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

New South Wales Branch (Medical Secretary, 135 Macquarie Street, Sydney): All contract practice appointments in New South Wales.

South Australian Branch (Honorary Secretary, 80 Brougham Place, North Adelaide): All contract practice appointments in South Australia.

Editorial Notices.

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